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EVOLUTION OF THE MODERN HEAVY GUN.

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DURING the last half of the nineteenth century, a period of extraordinary fertility in the industrial application of all departments of physical science, it would be remarkable if great progress were not made in the development of the materials of warfare, both offensive and defensive. It is true there have been few great wars during the half century just closing, fewer than during the corresponding previous period, when Napoleon made all Europe his chronic battle ground. But with progress in the arts of peace there comes progress in machinery of all kinds. Guns are machines which happily we are not often called upon to use in deadly earnest. The degree of perfection with which a machine does deadly work serves as a powerful argument to induce caution before bringing it into use. If the civilized world ever attains the millennium of freedom from warfare, it will not be because the philosophy of good will to men has triumphed, but because war is too terrible and costly for any nation to risk the sure and swift destruction it brings upon the vanquished. Patriotism will not be extinguished, but it will be tempered with the spirit of rational compromise. During the thirteen years of Napoleon's leadership his wars cost France one billion dollars. During the four years of civil war in America the cost to the Government of the United States was about four billion dollars, apart from treasures expended in vain by the Confederate States. The American civil war was thus at least a dozen times more expensive per year than war was during the time of Napoleon.

With the construction and use of the materials employed in modern warfare none but the professional military engineer can be reasonably expected to attain much familiarity. But all have an interest in national preparation for contingencies, and even to the nonprofessional it may be an engaging study to trace in outline the evolution of the cannon as now made at great armories like that at Watervliet, near Troy, New York.

It would be only repeating an oft-told tale to show that our remote human ancestors were all savages, and that the normal condition of society among them was that of warfare. What were the earliest weapons employed we can only conjecture. If we disregard the long and for the most part unknown period that preceded the beginning of definite human records, we find that when these records began man was already acquainted with the ruder processes of metallurgy. But there are no indications that during the age of universal savagery metal was used to any great extent for projectile purposes. Arrows and javelins were early and abundantly employed, and the use of the sling was undoubtedly common among the Israelites long before the dramatic duel between David and Goliath. The Romans in conducting their sieges employed the catapult and ballista for the projection of large arrows and stones; but from the vague description of these instruments we can glean little more than that they were probably immense crossbows. They were unwieldy, but powerful enough to project stones, each as heavy as an ordinary man, over a distance of a hundred yards. During the first dozen centuries of the Christian era there was but little improvement over Roman methods of warfare.

That the elastic force of hot gas suddenly evolved should be substituted for that of a stout cord under great tension could not have been possible without the previous discovery of the means by which such gas could be appropriately generated. There is no probability that we will ever learn definitely the true history of the invention of gunpowder. Quite probably it was independently invented by different persons at different times. There can be little doubt that the knowledge of its composition existed at a very early date among some of the inhabitants of India, where the rich soil under a tropical sun has during many centuries been leached for the purpose of procuring niter. Assuming the presence of this salt in abundance, it would hardly be possible for one who handles it to remain long ignorant of its capacity to explode when sufficiently heated in contact with charcoal, sulphur, or any other kind of fuel. It is not surprising that some of the earlier alchemists should be credited with the preparation of gunpowder. It has been common to attribute its invention to Roger Bacon, whose life lasted through the greater part of the

thirteenth century. But his language is characteristically vague; for, in regard to the mixing of saltpeter with sulphur and another undefined substance, he merely says, "You will thus make thunder and lightning if you know the method of mixing them."

ROGER BACON. Born near Ilchester, about 1214; died probably at Oxford in 1292.

Another claimant to the invention of gunpowder was the German monk, Berthold Schwartz, who is said to have ground together in a mortar a mixture of niter, charcoal, and sulphur. Accidentally allowing fire to come into contact with the mixture, an explosion ensued. The pestle was projected from the mortar and from the hand of the surprised alchemist. This suggested the use of the uncanny substance for military purposes, and the mortar was subsequently made on a larger scale for the special purpose of propelling projectiles.

The determination of the proper percentages of niter, carbon, and sulphur in gunpowder implies a knowledge of the quantitative laws of chemistry. It is not to be supposed, therefore, that the earlier users of this explosive were able to make powder equal in quality to that of modern times, or that they knew how to adjust its granulation to the special purposes intended under varying circumstances. The Saracens seem to have introduced it into Spain for pyrotechnic purposes about the same time that Schwartz made his suggestion regarding its most important practical application. Its first definitely known use was for cannon. These were called "bombards," on account of the noise occasioned by firing.

The primitive cannon was a rude tube made up of iron bars hooped together, edge to edge, like the staves of a cask. It was by no means readily portable, and was not provided with any wheeled carriage. As an offensive weapon its natural place was

on shipboard; as a defensive weapon, upon the wall of a besieged town. This iron barrel was firmly fastened down upon a horizontal bed or to a fixed framework of timber. The balls shot from it were of stone. Since there was no provision for aiming, it can be readily conceived that the enemy might be equally safe or unsafe at a variety of points in front of such an ostensible engine of destruction.

Small cannon, intended for transportation on land, were undoubtedly constructed early in the fourteenth century. They were used by the English, possibly as early as 1327, in battle with the Scotch, and certainly against the French in 1346, at the battle of Crécy. There is nothing to indicate that on this occasion any one was killed or wounded by a cannon. The sole function was that of frightening the enemy. Nor have we any record of the method of supporting or transporting such field artillery. It was rather as heavy artillery that cannon found their chief earlier use, and they were soon made of such size as to be quite comparable in this respect with modern guns. One of these bombards, made in Belgium in 1382, weighs about sixteen tons, is more than eleven feet long, and its caliber is about two feet. It is still kept on exhibition in the city of Ghent. Another is the "Mons Meg," made in 1486 at Mons in Brittany. It was captured by the Scotch, and is now kept at Edinburgh.

"Mons Meg" Cannon at Edinburgh.
Caliber, twenty inches. Made in 1486 at Mons, Brittany. The arrangement of hoops around staves is shown at the part injured by its bursting in 1682.

A gun somewhat similar in construction to that in Ghent was dug up about forty years ago from the bed of a river in Bengal, and now stands on exhibition in the city of Moorshedabad. It was made of wrought iron, was more than twelve feet in length, and about seventeen inches in caliber. That the forging of iron on so large a scale was accomplished at such a time and in such a place indicates a marked degree of progress in metallurgy in the far East, and adds force to the thought that cannon may have been in use in Asia long before they were ever employed in Europe.

During the siege of Constantinople, in the fifteenth century, according to Gibbon, the Turks employed cannon with which stone balls, each six hundred pounds in weight, were projected, and the walls of the city were thus breached. Von Moltke mentions such a gun at the same place, twenty-eight inches in diameter at the muzzle, with which a ball more than fifteen hundred pounds in weight was projected by a charge of one hundred

pounds of powder. For some of these ancient Turkish cannon the diameter of the stone shot was as much as a yard, while the length of the gun was only five yards.

It is not therefore so much in the size of heavy ordnance as in its efficiency that we of to-day are warranted in claiming much superiority over our ancestors. The plan of hooping iron staves together gradually gave place to that of molding guns, sometimes in cast iron, sometimes in bronze. Wrought iron also came extensively into use for the purpose of gun construction. The gun was made up of a succession of short forged tubes jointed together. Over each joint a ring was shrunk on while hot, for the sake of strengthening the whole. Many guns made in this way during the sixteenth century are still to be seen in European museums.

The use of breech-loading cannon is of considerable antiquity, despite the great difficulty that has been experienced in securing safety in their use. Among the earliest breech-loading devices was that of a short movable tube or chamber, closed at one end. This was loaded to its muzzle and then inserted into the breech of the large tube. It was propped behind with a heavy block of wood or iron, and firmly wedged into position before firing. It is readily seen that with such loose fittings much of the force of the powder was wasted. None of these guns were provided with any facilities for adjustment in aiming. The stone projectile was but poorly fitted to the size of the bore. Not only did much of the expanding gas escape without doing useful work, but the strength of the gun was never sufficient to warrant a charge of powder large enough to send the projectile more than a few hundred yards.

In course of time it became evident that greater efficiency was attainable by the use of smaller cannon and more accurate fitting. The clumsy and unmanageable heavy guns were discarded, and their places supplied by guns many of which were small enough to be carried by a single man. The introduction of the musket was merely one phase in the fluctuation of the waves of custom, a reaction after many unhappy experiences in the use of large cannon which had been inefficient and often more dangerous to the user than to the enemy. The musketeer with his burdensome flintlock became more important than the cannoneer in field work. A variety of forms of small cannon came into use, all of which were, like the muskets, smooth-bored, muzzle-loading arms, made of cast metal of one kind or another. Iron balls were substituted for those of stone, and about the beginning of the present century a weight of eighteen or twenty pounds was deemed best for most artillery purposes. War ships were equipped with armaments sometimes in excess of a hundred small cannon. Custom had

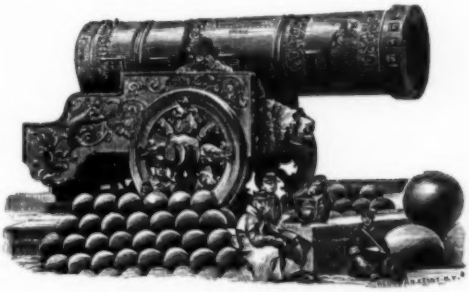
fluctuated to the other extreme, but at this stage of evolution guns had become well differentiated into two classes, the musket and pistol being representatives of the one, while the portable cannon was a type of the other. Each was crude in comparison with the war machines of to-day, but efficient enough to make Napoleon the terror of Europe. This warrior's celebrated remark that "God is on the side of the heaviest artillery" was an indication of his view that the limit had not been reached, and that the art of cannon construction was enough developed to warrant the making of yet larger guns.

In the War of 1812 an American officer, Colonel Bomford, introduced a large cast-iron gun, intended specially for seacoast defense by firing bombshells at long range. Up to this time cannon had been made with little or no provision for the variation of stress in different parts of the gun due to the exploding powder. It was known that this stress must be greatest around the seat of the charge, but no experiments had been made to determine even roughly the rate of decrease, although methods were already in use for ascertaining the initial velocity of the projectile shot forth. Bomford bored a hole into the side of a cannon and screwed into this a pistol barrel, with a bullet inserted. A definite charge of powder being exploded in the cannon, the velocity of the pistol bullet gave a measure of the pressure at that point. A series of holes being made in succession from muzzle to breech, the corresponding velocities of the discharged bullets gave an indication of the relative strengths needed to resist explosion and the thickness of metal required. The form of gun was therefore modified to suit the stress, and greater strength in proportion to weight was thus secured. To this improved gun he gave the name of columbiad. This style of gun was soon adopted in Europe, and long continued to be a standard.

But there were inherent weaknesses due to the very fact of employing cast metal. Assume a mass of hot liquid iron poured into a mold to form a solid cylinder, the central part of which is to be afterward bored out. The exterior surface cools first and becomes a rigid solid, while the whole mass has contracted but little. Gradually the interior hardens and crystallizes, but normal contraction is prevented by the rigidity of the exterior shell. The condition of the mass is much like that of a Rupert's drop of glass, which breaks into fragments as soon as the outer shell is broken. The weakest part of the cylinder is the axial region, which is removed by being bored out; but still the weakest parts of the completed gun are its inner surface and breech, the very parts against which the greatest force of the exploding charge is exerted. With such a gun the limit of safety is exceedingly uncertain. The vibration due to discharge weakens the cast iron,

and the gun becomes dangerously weak after but little use. Nevertheless, this method of construction did not begin to receive modification of any great importance until about fifty years ago. In 1846 these smooth-bore, cast-iron columbiads varied in caliber from eight inches to twenty inches, and in weight from four tons to fifty-seven tons. The projectiles were spherical iron balls, from sixty-eight to one thousand pounds in weight, the charge of powder never exceeding one sixth of the weight of the ball.

Between 1850 and 1860 Major Rodman, of the United States Army, conducted an epoch-making series of experiments on the improvement of gunpowder and the method of casting iron guns. Dahlgren, about the same time, modified the form of gun, giving it great thickness at the breach and as far as the trunnions, with rapidly diminishing diameter thence to the muzzle. This form has often been compared to that of a champagne bottle. The contrast between this and the older forms is well shown by comparing the "Tsar cannon," a thirty-inch gun of the seventeenth century, now in the arsenal at Moscow, with the United States fifteen-inch columbiad, as improved by Dahlgren. Accepting the proportions thus established, Rodman devised the method of "hollow casting" and cooling from the interior. The melted iron is poured into a vertical mold, the axis of which is occupied by a hollow core. Through a pipe in this cold water is conveyed to the bottom and conducted away at the top after being warmed by the surrounding hot metal. The hardening of this begins thus at the inner surface where the greater strength is needed. The exterior surface of the mold is at first strongly heated from without and this heat gradually diminished, while the flow of water is continued many hours or even days. The cast iron thus goes through a process much like the tempering and annealing of steel. As the metal gradually cools the inner surface becomes strongly compressed, and the outer surface is left in a state of tension. The condition is the exact reverse of that brought about by the older process of solid casting and subsequent boring. The great improvement in strength secured by this process is indicated by Rodman's testing of two columbiads of the same size, material, and form, made at the same time, the one by hollow casting, the other by solid casting. The solid-cast gun burst at



THE TSAR CANNON AT MOSCOW.
Caliber, thirty inches. Seventeenth century.

the eighty-fifth round, the hollow-cast at the two hundred and fifty-first round. Its endurance was thus three times that of the other.

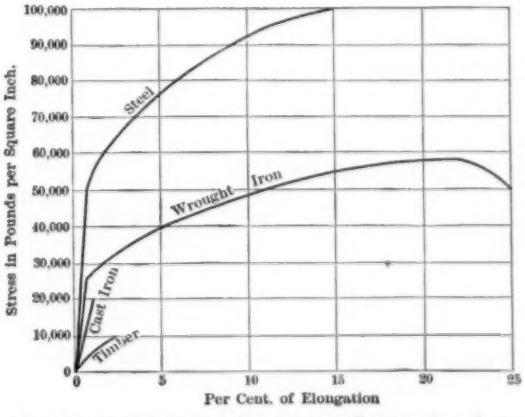
Rodman's process was of fundamental importance, because it established experimentally the principle of initial exterior extension and interior compression. This principle is applied in all gun construction to-day, although the use of cast iron has been wholly discarded. Like many other ideas of great importance in the history of invention, it seems to have been evolved independently by several claimants. The names of Blakely, Whitworth, Armstrong, Longridge, Brooke, Treadwell, and Parrott are at once called to mind. To describe their inventions and discuss conflicting claims would require a volume. The discovery of such an important principle, followed by the outbreak of the American civil war, gave an impetus to the improvement of ordnance which was felt over the entire world.

RODMAN FIFTEEN-INCH GUN.

Hitherto the materials used in gun construction were cast iron, wrought iron, and bronze, this last being an alloy of copper with ten per cent of tin. In tenacity bronze is superior to cast iron, but it is softer, more fusible, and more expensive. Cast iron is moderately fusible, but not fixed in composition, having a variable amount of carbon, silica, and other impurities diffused through its mass. Its properties are correspondingly variable, but it is in general hard, brittle, and more or less crystalline. Wrought iron is the result of oxidizing out all of the carbon by puddling, then squeezing out the silica, and rolling so as to develop a fibrous in place of crystalline structure. It is much more tenacious than cast iron, almost infusible, but capable of ready welding and forging. The admixture of carbon seems to confer the property of fusibility.

Steel is the product of the recombination of pure wrought iron with a very small percentage of carbon and sometimes of manganese or nickel. Like cast iron, it is fusible; like wrought iron, it can be readily forged; and it is superior to each in elasticity and tenacity. The idea long ago suggested itself that steel ought to be the best material for the construction of cannon. But the practical obstacle was the great difficulty of securing large enough forgings of steel, and this of sufficiently good quality. Only since 1860 have the methods of steel manufacture been so improved as to make this metal available on a large scale.

So important is the relation between cast iron, wrought iron, and steel that it may be well to illustrate this by the use of a diagram due to Professor Merriman. Assume that short rods of these materials, each of the same length and one square inch in cross-section, are subjected to great stretching force by the use of a testing machine. As this force increases up to the elastic limit of six thousand pounds, the cast-iron rod becomes elongated proportionally. It breaks suddenly when the stress reaches twenty thousand pounds. At this limit of tenacity the rod has been increased in length less than one per cent, as shown in the diagram. The wrought iron becomes lengthened at a less rapid rate, reaching its elastic limit for a stress of about twenty-five thousand pounds. In each case, up to the elastic limit, if the stretching force be removed the rod will recover its former length and condition. On further increasing the stress, the wrought iron stretches at a more rapid rate, and bears a stress as great as fifty-eight thousand pounds. If now the force be withdrawn the iron remains in its deformed condition, the lengthening being about twenty-two per cent. On again applying the stress there is further rapid lengthening up to twenty-five per cent, this yielding causing a decrease of stress till the rod breaks at a limit below fifty-eight thousand pounds. The elastic limit and the breaking limit are thus widely different. In the case of steel the elastic limit is not reached until the stress becomes fifty thousand pounds. Its elastic limit is thus double that of wrought iron. Further increase of stress now causes the steel to increase its rate of stretching, and permanent strain results. Its breaking limit, one hundred thousand pounds, is nearly double that of the wrought iron, and is reached when the yielding attains fifteen per cent. This is not much more than half of the twenty-five per cent of yielding of the wrought iron.



CURVES SHOWING TENSILE STRENGTH OF TIMBER, CAST IRON, WROUGHT IRON, AND STEEL.

The figures just given are only averages. Cast iron has been made with a tenacity in excess of forty thousand pounds, while that of steel may vary in different specimens from sixty thousand to three hundred thousand pounds. This wide range shows that for

the construction of a heavy gun, if steel be employed, the utmost care should be exercised to secure that of the highest grade possible, in order to withstand the enormous tension due to explosion. As soon as this tension becomes equal to the limiting measure of elasticity for the steel, the wall must yield, even if the thickness of the gun were infinite. Since the breaking limit, or ultimate tenacity, of cast steel has just been seen to be, on an average, at least five times that of cast iron, it follows that, with the same diameter and thickness of metal and the same weight of projectile, a steel gun warrants the use of a charge of powder of the same quality five times as great.

Professor Treadwell showed in 1856 that, if we assume a gun to be made up of a large number of uniform, cylindrical, concentric layers of metal, then the resistance of each layer to the bursting force of explosion will vary inversely as the square of the diameter. The stress, therefore, decreases at a rate very similar to that of the radiation of heat or light. If the wall of the gun be under no initial stress of any kind, its inner portion must have great resisting power, and very little is gained by thickness of wall much in excess of the diameter of the bore. Treadwell therefore proposed a plan of construction by which a cast-iron tube of only moderate thickness should be re-enforced by a series of layers of encircling wrought-iron hoops. These should be shrunk on while hot, so that, after cooling, the cast iron tube is strongly compressed while the wrought-iron hoop becomes stretched. The force of compression is thus added to the ordinary strength of the cast iron to resist explosion. With various modifications this plan has been carried out by most gun constructors during the last forty years. During the civil war it was applied with great success by R. P. Parrott, of West Point, and by Blakely, Armstrong, and Whitworth in England.

It is perhaps impossible to say what inventor was the first to introduce the use of rifled cannon. They have now entirely superseded smooth-bore guns. The Parrott rifled cannon, made of cast iron according to the Rodman plan and re-enforced around the chamber with a hoop of wrought iron, was the most generally serviceable gun employed during the late war, more than two thousand of them coming thus into use. The largest of these was twelve feet in length, with a bore ten inches in diameter, its weight being about twelve tons. A charge of twenty-five pounds of powder was employed to project a shot weighing two hundred and fifty pounds. The cost of its construction in 1863 was forty-five hundred dollars.

These details are given for the sake of subsequent comparison with the rifled cannon of to-day. For twenty years after the close of the war there was a period of stagnation in America, so far

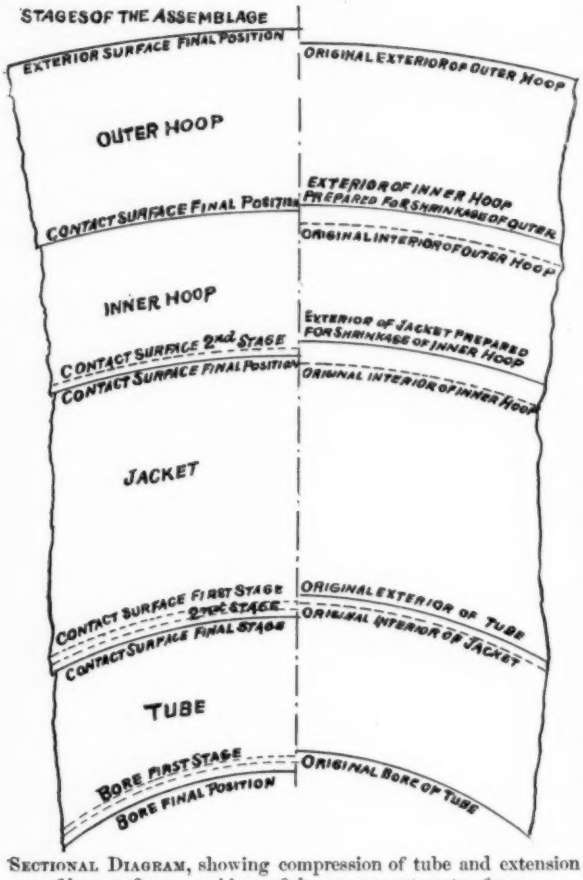
as development in ordnance was concerned. Our coast defenses continued to be provided with nothing better than the Parrott rifles and smooth-bore Rodman guns which had been in use during the war. Meanwhile there had been great progress in Europe, particularly in France and Germany. In 1885 a commission appointed by Congress reported the necessity for heavy expenditure of money in order that this country be put into a condition of reasonable readiness to repel foreign invasion. During the last ten years appropriations to the amount of twenty million dollars have been made to meet these needs, and the work of rehabilitation is now well started.

The rifled gun of to-day, as finished at the Watervliet Arsenal, is constructed almost wholly of steel. This is of the best quality that can be produced on a large scale in American foundries. It is made by the "open-hearth" process, for the most part at Midvale and Bethlehem in Pennsylvania. The forgings, after undergoing thorough official inspection and careful testing, are sent to the great gun shops at Watervliet. Here the various parts composing a gun are worked up, assembled together, and finished. Before assignment for government service each gun is subjected to a searching test, more severe than should reasonably be expected in actual use.

The largest gun thus far designed at Watervliet is a rifle of twelve-inch bore, forty feet in length, and fifty-seven tons in weight. From such a gun an elongated steel-pointed projectile, weighing one thousand pounds, or as much as an ordinary horse, is shot with a charge of five hundred and twenty pounds of powder. It receives an initial velocity of two thousand feet per second, and would penetrate through rather more than two feet of steel armor plate put in front of the muzzle. If shot into the air at the proper elevation it would pass over a range of nearly nine miles. Such a missile, thus fired from the lower end of New York city, would pass over Central Park into the district beyond Harlem River. This range would be covered so quickly that the shot would reach its destination several seconds before the sound of the explosion is heard at the same point. The initial energy of the projectile would be sufficient to lift a weight of twenty-seven thousand tons through a height of one foot. If this weight were that of a spherical mass of gold, the heaviest popularly known metal, its diameter would be nearly forty-six feet, and its value eighteen billion dollars. This is more than a dozen times the value of the total gold production of the world during the last twenty years.

The cost of such a gun is about sixty thousand dollars; that of the charge of powder, one hundred and seventy-five dollars; of the armor-piercing projectile, three hundred and fifty dollars.

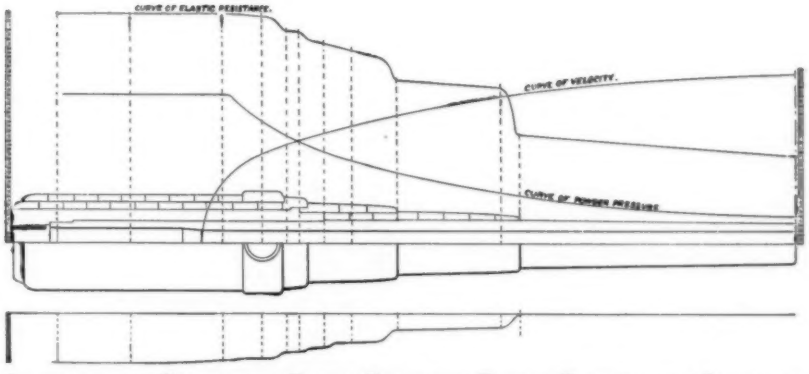
The cost of a single discharge thus exceeds five hundred dollars. But this is not all. So great is the wear and tear of each discharge upon the bore that after two hundred and fifty rounds the gun becomes unfit for further use until it is relined by the insertion of a new rifled tube within the original tube, the old rifling having been removed. The gun will then stand two hundred and fifty more rounds. Assuming six hundred rounds for the entire life of the gun, each round thus costs one hundred dollars in wear and tear, in addition to the five hundred dollars' worth of material used in loading. Such a gun as this is but a single small element in the cost of a modern war.


STAGES OF THE ASSEMBLAGE
EXTERIOR SURFACE FINAL POSITION
ORIGINAL EXTERIOR OF OUTER HOOP
OUTER HOOP
EXTERIOR OF INNER HOOP PREPARED FOR SHRINKAGE OF OUTER
CONTACT SURFACE FINAL POSITION
ORIGINAL INTERIOR OF OUTER HOOP
INNER HOOP
EXTERIOR OF JACKET PREPARED FOR SHRINKAGE OF INNER HOOP
CONTACT SURFACE 2nd STAGE
CONTACT SURFACE FINAL POSITION
ORIGINAL INTERIOR OF INNER HOOP
JACKET
CONTACT SURFACE FIRST STAGE
ORIGINAL EXTERIOR OF TUBE
2nd STAGE
ORIGINAL INTERIOR OF JACKET
CONTACT SURFACE FINAL STAGE
TUBE
BORE FIRST STAGE
ORIGINAL BORE OF TUBE
BORE FINAL POSITION

SECTIONAL DIAGRAM, showing compression of tube and extension of hoops after assemblage of the component parts of a gun.

Several of them, besides a number of smaller guns, are usually placed on every large armor-clad battle ship. The cost of this with its equipment mounts up into millions of dollars. Nevertheless, it has been necessary to coin into our language the word "jingo," to designate the bragging noncombatant who clamors for war because of the fancied stimulus which it is supposed to give to patriotism and prosperity. On comparing this gun with the largest Parrott rifle of thirty years ago we see that its length is more than three times, its weight nearly five times, and its cost thirteen times as great. For the cast-iron Parrott gun the charge of powder weighed about one tenth as much as the projectile. For the modern steel gun this ratio is raised to one half, with corresponding increase of destructive energy.

Passing now to the construction of the modern gun, a longitudinal section shows an inner tube rifled within and slightly enlarged at the breech end of the bore. Around this is a long tubular jacket extending from the breech two thirds of the length of the gun. Around this jacket is a series of compressing hoops, and around this a second or outer series of the same. Originally the interior diameter of the jacket is a little less than the exterior diameter of the tube. By heating the jacket sufficiently it is made to expand until it can be slipped over the cold tube, which becomes enormously compressed by the subsequent cooling of the jacket. In like manner the first hoop is too small to be slipped over the cold jacket except when heated for this purpose. The same remark applies to the second hoop. The final result, as shown by the cross-sectional diagram on opposite page, is that the diameters of the tube, both internal and external, are permanently diminished by the compression of the jacket, while those of the hoops are permanently increased. Their contractile force is not sufficient to compress the jacket, which is itself resisting the enormous reacting force of the compressed tube within. The hoops therefore serve to re-enforce the jacket by their own tendency to contract from the enlarged condition in which they were applied while hot. They are in a state of permanent tension. The scale of differences exhibited in the diagram is greatly exaggerated to make these perceptible. The longitudinal diagram shows by curves how the expansive force of the exploding powder diminishes from breech to muzzle, how the yet greater elastic

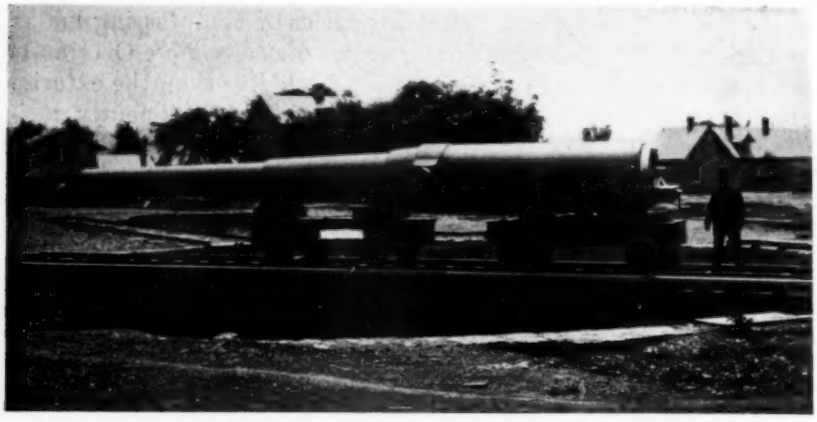


CURVES SHOWING DECREASE OF ELASTIC RESISTANCE, POWDER PRESSURE, AND INCREASE OF PROJECTILE VELOCITY.

resistance of the steel components, after they are assembled together, is adjusted to resist this expansive force, and how the velocity of the projectile increases from breech to muzzle.

All rifled guns built in America at present, whether for seacoast, siege, or field artillery, are breech-loading. Many futile

experiments were made before a successful breech-loading mechanism was perfected. An explanation of either of the two modern systems would be beyond the scope of the present discussion. It



TWELVE-INCH RIFLE, WITH BREECH-LOADING MECHANISM CLOSED.

may be sufficient to say that the system in use in America is substantially that of the French, an interrupted screw which fits into the breech and is provided with an efficient gas check. This is so constructed that the mere fact of explosion tightens the gas check and effectually prevents the escape of hot gas between the threads of the screw.

The largest and most celebrated gun factory in the world is that of Krupp, at Essen in Germany, near the Belgian border. Besides monopolizing the construction of guns for the German Government, this factory has supplied a great number to most of the leading powers of Europe. It was established in 1818, and from the very outset attention was concentrated upon the making of steel. The first finished piece of artillery in cast steel was made in 1847. This was a small field gun capable of projecting a ball of only three pounds. The manufacture of steel at these works has since been so perfected that Krupp can now be scarcely said to have an acknowledged rival in the world. His magnificent display at the Chicago Exposition was seen and admired by many thousands of visitors. Among these exhibits was a steel rifle forty-two centimetres (16·54 inches) in caliber, and thirty-three calibers (forty-six feet) in length. Its weight is one hundred and twenty tons, or a little more than double that of the twelve-inch rifle at Watervliet. With a charge of nine hundred pounds of powder it gives an initial velocity of two thousand feet per second to a projectile weighing twenty-two hundred pounds, whose initial energy is thus sixty thousand foot tons. When fired at an elevation of about eleven degrees it sends this projectile to a dis-

tance of five and a half miles, and it pierces through armor a yard thick at a distance of a mile and a quarter. Another rifle, twenty-eight centimetres (eleven inches) in caliber and forty calibers (thirty-seven feet) in length, when elevated forty degrees sends a seven hundred and sixty pound projectile over twelve and a half miles. This is the distance from the Battery to Fordham in New York city. The shot reaches an extreme height of a trifle over four miles. It could thus be easily made to clear the highest mountain peak in North America.

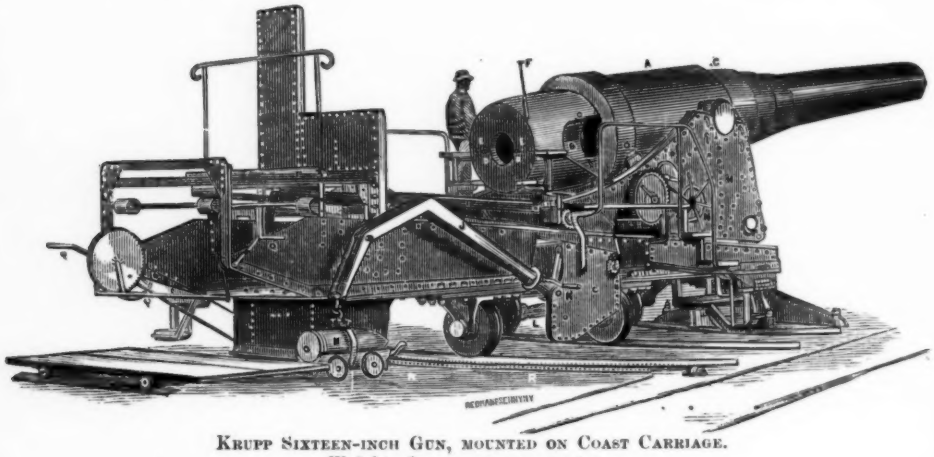
The power of endurance of a gun diminishes rapidly with increase of projectile power. The life of the American twelve-inch rifle has been given as only five hundred or six hundred rounds, while a field gun of modern make may be fired thousands of times if used with reasonable care. Within the next two years a new rifle of sixteen-inch caliber will be constructed at Watervliet. This is nearly equal in size to the monster Krupp gun at Chicago. Such immense guns can be employed only for seacoast defense. In handling them complex machinery is necessary, not only for moving and adjusting the gun but for loading it. No group of soldiers could without machinery lift and put into place a projectile weighing a ton. It seems doubtful whether any real advantage can be gained by going beyond the limits of size already

TWELVE-INCH RIFLE, WITH BREECH-LOADING MECHANISM OPEN.

reached. The difficulty at present is not confined to that of manipulation, but extends to the quality of the forgings made on so large a scale. Krupp makes his guns entirely of "crucible" steel, such as is employed for cutlery. Made by this method, steel is indeed the most uniform in composition, but nowhere outside of the Krupp works has it been manufactured on a scale large enough for great gun forgings. In France, in England, and in America, the "open-hearth" process is depended

upon, which yields a high grade of steel; but in uniformity of composition and elasticity it can scarcely be equal to the more expensive crucible steel. This perhaps may at present be only a matter of opinion. On such a point no definite and final conclusion should be reached without a series of comparisons such as can not be accomplished in a day.

An unfortunate mishap which occurred at Watervliet in 1895 may have some bearing in this connection. In assembling the parts of a forty-caliber twelve-inch rifle, the tube was, as usual, rested vertically upon its breech end, and the heated jacket was let down over it. The heating had been insufficient to secure all



KRUPP SIXTEEN-INCH GUN, MOUNTED ON COAST CARRIAGE.
Weight of gun, seventy-one tons.

the expansion needed, and as a result the cooling jacket gripped the tube before quite reaching the final position intended. An interesting problem was now presented, that of separating the tube and jacket after they had become thoroughly cool, and completing the process which had been so unexpectedly interrupted. The gun was provided with the inlet and outlet tubes such as Rodman employed to secure a continuous flow of water in hollow casting, and the exposed part of the tube below the edge of the jacket was inclosed in a bag of asbestos cloth through which a stream of cold air could be transmitted. The gun with its adherent jacket and these adjuncts was let down into a furnace so as to heat the jacket. Immediately a flow of cold water was started through the tubes, and of cold air through the bag, while the inclosing jacket was soon raised to a temperature estimated to be 1100° F., which was maintained for several hours. The experiment proved unsuccessful. It was subsequently repeated twice with slight modifications, but all in vain. To test the correctness of the theory thus applied, a "dummy" was constructed, its parts

assembled together firmly, and the experiment of separating them was rewarded with prompt success. On account of the magnitude of the large gun it had been impossible to heat it with perfect uniformity from without, while no such difficulty was experienced with the much smaller dummy. A series of measurements upon the large gun revealed the fact that during the first experiment it had become warped, and the diameter of the tube had been diminished in varying degrees at different parts.

Whether such results as these would have been brought about had the materials been of the best quality of crucible steel instead of open-hearth steel can not be answered positively. The larger the gun the greater is the danger of such mishaps. It is left to coming experience to determine which is to be the steel of the future for gun construction.

THE SILENT CITY OF THE MUIR GLACIER.

By DAVID STARR JORDAN,
PRESIDENT OF LELAND STANFORD JUNIOR UNIVERSITY.

MR. RICHARD G. WILLOUGHBY is a mining prospector and "promoter," resident in Juneau, Alaska, a man whose vocation enables him to see some wonderful things. In June, 1888, according to his statement, Mr. Willoughby beheld an extraordinary mirage from the surface of the Muir Glacier. It was the apparition of a great city of tall houses of brick and stone, plainly shown in the air under the influence of some powerful refraction. Behind the city was a river in which shipping was faintly shown. In the foreground the leafless branches of tall elm trees were clearly traceable. In the center of the city was a large edifice with several towers, and on some of these towers the presence of scaffolding showed that building was still going on. This mirage was seen by him several times from year to year, and on the unfinished building the stages in the process of erection each season could be distinctly followed.

Mr. Willoughby sent to San Francisco and secured a camera with a number of highly sensitized plates of the usual commercial sort in order to photograph the apparition. This he succeeded in doing but once successfully. The necessary exposure was a very long one, because of the unsubstantiality of the object. The one negative, however, gave a fairly clear print. Copies were at once made, and R. G. Willoughby's Silent City (seventy-five cents each) was added to the wonders of Alaska. I present herewith a copy of this picture bought by me in Sitka in 1896. The picture is not quite the same as the original edition of 1888.

The scene is exactly identical, but the card has been reduced in size by the omission of superfluous sky. It has been rendered much fainter and more ghostlike than the original, and is perhaps taken from a new negative in which the lines of the houses and gravel walks have been purposely made less distinct.

The original edition has the following on the back of the card:

"THE GLACIAL WONDER OF THE SILENT CITY.

"For the past fifteen years Prof. Richard Willoughby has been a character in Alaska as well known among the whites as he has been familiar to the natives. As one of the early settlers of old Fort Wrangel, in which his individuality was stamped among the sturdy miners who frequented the then important trading port of Alaska, he has grown with the Territory and is to-day as much a part of its history as the totem poles are identified with the deeds of valor or commemorative of the past triumphs of prominent members of the tribes which their hideous and mysterious characters represent.

"To him belongs the honor of being the first American who discovered gold within Alaska's icy-bound peaks, but his greatest achievement from a scientific standpoint is his tearing from the glacier's chilly bosom the 'mirages' of cities from distant climes.

"After four years of labor amid dangers, privations, and sufferings, he accomplished for the civilized world a feat in photography heretofore considered problematic.

"It was on the longest day of June, 1888, that the camera took within its grasp the reproduction of a city remote, if indeed not altogether within the recesses of another world. The

SILENT CITY

is here presented for the consideration of the public as the wonder and pride of Alaska's bleak hills, and the ever-changing glaciers may never again afford a like opportunity for the accomplishment of this sublime phenomenon."

The picture attracted much attention and met with an encouraging sale. The skeptical bought it as an original document in the natural history of mendacity. The credulous regarded it as a wonder not surpassed by the gigantic glacier itself. The discussion arose in the newspapers as to whether some distant city, as Montreal, could have been brought into view by the freaks of the marvelous Alaskan atmosphere. Many who thought this impossible leaned to the belief that in the heart of Alaska or in British Columbia there is some great settlement of civilized men, as yet undiscovered by geographers. To those who held this opinion neither the nearness of the houses to the observer nor the

101 R. G. Willoughby's Mirage [the Silent City.] Alaska

peculiarities of the vegetation (leafless elm trees in midsummer) nor the tiles on the chimneys offered any difficulties. The obvious but commonplace explanation was that of the few only. Even now, every summer, some account of the marvel goes the rounds of the newspapers. I am told that in 1896 a company of people encamped for some time on the glacier, in hopes of seeing this great wonder of Nature.

They did not see it, unfortunately, but others had better success, and these lucky ones have recently substantiated their account by their affidavits. An affidavit in Juneau costs but a drink of whisky, the usual price along the Northwest coast, a fact of which one great nation of our day has not been slow to profit in connection with an International Tribunal of Arbitration. As the sale of photographs declines, more persons will probably be granted a sight of the Silent City, and there will arise a new series of affidavits and newspaper stories.

It is hardly necessary to call the attention of the intelligent reader to the absurdities involved in Mr. Willoughby's story and in the photograph which is its financial justificaion. But there are many persons, not without education and culture, who believe without the least question any tale which is uncanny or which seems outside the ordinary run of things. In vain does Science protest that the natural order is the only order there is, that all contradictions to it are either so in appearance only or else are deceptions or frauds.

An interest in human psychology led Dr. Charles H. Gilbert, then acting as naturalist on the Albatross, to investigate Mr. Willoughby's methods of photography. He learned from Mr. Willoughby that the plates used were of the ordinary sort, but that the mirage required a very long exposure to set the picture. Mr. Willoughby had had no previous knowledge of photography, and had never tried to reproduce anything except mirages. The chemicals used in developing the negative he would not describe. It was a secret process. The exposed plates had to be soaked for three months in the secret compound before the picture would be fixed. This soaking took place in the open daylight, no dark room being required, nor did Mr. Willoughby seem aware of the ordinary function of the dark chamber in photography.

The original negative, examined by Dr. Gilbert, was a very old, stained, and faded plate, apparently a negative which had been discarded because underexposed.

Prof. William H. Hudson, of Stanford University, who lived for a time in Bristol, England, recognizes the picture as a view of that city from Brandon Hill, above the town. The picture must have been taken some twenty years ago, because Prof. Hudson distinctly remembers the scaffolding around the towers

of Bristol Cathedral at that time while the building was being repaired. The hotel and the church to the left of the cathedral are also recognized by him.

A more transparent fraud could hardly be devised, but its very imbecility assures its success. We may be certain that for many years to come the "Silent City" will be the "wonder and pride of Alaska's bleak hills," and tourists eager to "pierce the veil" will speculate on the probability of its being "perhaps altogether within the recesses of another world."

Thus it comes about, as I have elsewhere said, that "there is no intellectual craze so absurd as not to have a following among educated men and women. There is no scheme for the renovation of the social order so silly that educated men will not invest their money in it. There is no medical fraud so shameless that educated men will not give it their certificate. There is no nonsense so unscientific that men called educated will not accept it as science."

PRINCIPLES OF TAXATION.

By DAVID A. WELLS, LL.D., D.C.L.,
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VIII.—NOMENCLATURE AND FORMS OF TAXATION.

THE most simple form of taxation is a *poll* or *capitation* tax. Both terms may be regarded as identical in use and meaning, but the former is probably more frequently used in tax treatises and discussions.

WHAT IS A POLL TAX?—In a strictly economic sense the essential requisite of a "poll" or "head" tax is that it be laid on all polls or heads, and be unvarying in amount. A varying poll tax would be an arbitrary exaction, and would not be sustained for a moment as a proper exercise of the right of taxation, if laid without reference to a man's ownership of property. So soon, however, as the amount of the tax exacted is made dependent upon the amount of the property owned, the tax ceases to be a varying poll tax, and becomes a tax on the property itself. The popular idea of a poll tax in the United States is an annual tax, small in amount, uniform as respects rate, and applicable only to adult male persons. Such conceptions are not, however, in accord with historical experience, which is to the effect that uniformity in assessment has never been an essential or even usual feature of this form of taxation, but as a rule the tax has been intentionally rated to the person assessed according to his rank and station and supposed property. The "poll" or "capitation" tax of history has, therefore, been rather an "income" than a *per capita* tax; and the

poll tax of the United States finds few precedents in history. Under the Byzantine Empire a so-called universal poll tax was substituted in lieu of almost all the tithes, customs, and excises which had before been relied on for revenue; and this substitution and its influence was regarded by Hume as one of the chief causes of the decadence of the Roman state (see page 584, vol. xlviii, March, 1896).

The first so-called poll tax in England was granted in 1377, and from that date down to the time of Queen Anne was an important source of revenue, and, not being uniform, except in its incidence *per capita*, gave rise to great popular dissatisfaction, both by reason of its amount and inequality, and also by the inquisitorial methods employed for its assessment and collection. At first (1377) the rate was fourpence on every head, male and female, above fourteen years of age. Subsequently, under the reign of Richard II, in order to avoid the unfairness of subjecting all—rich and poor, noble and serf—to such a uniform tax, a more equitable system was introduced, the taxpayers being classified by reference to rank, condition of life, and property, the rate ranging from six pounds thirteen shillings for dukes and archbishops, to two pounds for barons and knights, and three shillings fourpence on those of "least estate." The retention of the former uniform rate of fourpence on all married laborers and upon all single men and women above fourteen years of age, who were presumed to be without estate, was, however, a cause of great dissatisfaction among the masses, and the attempt to collect it undoubtedly constituted the prime cause of the famous "Wat Tyler rebellion" of 1381. In the case of the last poll tax authorized in England under Queen Anne a like attempt at classifying persons was continued; the rate commencing at one shilling per annum on all persons worth more than fifty pounds, and rising to ten pounds for peers of the realm, both spiritual and temporal. One curious provision of this final enactment was, that in all cases Catholics were to pay double the rate imposed on Protestants. Bachelors and widowers without children were also subjected to special rates. Some writer has remarked that such exactions could only have been designed and authorized by a government of misanthropes; for if one with a view of escaping them abandoned single blessedness, he only involved himself in greater difficulties; for there was a tax upon marriages, a tax upon births, and, if the health of the victim broke down under these exactions, a sum varying from three to thirty florins, according to his station, had to be paid before his sorrowing relatives could bury him. These taxes on marriages were enforced in England from 1695 to 1705, and during the first five years of their continuance yielded an average annual revenue of about two hundred and fifty thou-

sand dollars. It was noted that their continuance had the undesirable effect of increasing the number of marriages by irresponsible persons, and in a manner devoid of all solemnity. The rates imposed in England as late as 1706 on bachelors and widowers contracting marriage varied according to the class in life to which they belonged; from thirty pounds to twenty-five pounds on the elder sons of the higher orders of nobility to twelve shillings on persons possessed of an income of fifty pounds per annum.

Within a very recent period a petition, numerously signed, has been presented to the French Chamber of Deputies asking that a special tax on bachelors be established in France, and recalls the fact that the French revolutionary Convention of 1789, and some of the old republics, established such a tax. The petition further stated that the number of bachelors in Paris is nearly half a million, while the number of married men is not more than 379,000; and "that such a tax ought to be doubly welcome in France: *first*, because it will increase the declining population of the state by inducing bachelors to marry; and, *secondly*, because it will help to make up a growing deficiency in the national budget." In Switzerland, in the assessment of an income tax and taxes on dwelling houses, certain deductions allowed to married persons with families, are not allowed to bachelors or childless married people.

Legislation looking to the taxation of bachelors has also been seriously proposed of late in several of the States of the Federal Union. In Illinois, for example, a bill has been introduced in its Legislature imposing a uniform tax on all single men, sound in mind and body, above thirty-two years, who are not able to show that they have proposed marriage three times—and been rejected. The proceeds of the tax are to go toward establishing a home for worthy and indigent single women above the age of thirty-eight.

A Missouri bill makes the tax progressive, increasing by successive increments as the bachelor persists in his state of single blessedness.

In modern times (1848) an English Governor of Ceylon—Lord Torrington—undertook to repeat the experience of his countrymen of near five centuries before, by imposing a poll tax of three shillings per annum, or one week's labor, valued at three shillings, from every man, rich or poor, in the colony. This exaction, in point of inequality, was worse than the poll tax of Wat Tyler's time, inasmuch as it made the average income of the poorest laborer the standard according to which the rate of taxation was to be established for all. There was also another curious feature connected with this experience. The Cingalese priesthood were held liable to pay this tax, either in money or a week's work, when their religion required that they must neither perform

work nor possess property. The result was a revolt attended with much bloodshed, an abandonment of the tax, and the recall of the Governor.

In one of the states of Central America a poll tax was recently required to be paid monthly; all adult male inhabitants of the several towns and cities being obliged to present themselves at the municipal treasuries and pay their dues in person.

In the colonial period of our history the poll tax was enacted by nearly all the North American colonies at one time or another. In Virginia and Maryland it was for a long time the only direct tax; and in the latter State it was imposed upon all free men and free women, and upon all free children over twelve years of age; and was rendered particularly odious and burdensome from the circumstance that its payment was required in tobacco, a given number of pounds to the head, the value of which commodity was not constant, but varied with supply, which at times was intentionally restricted, with the intent of augmenting its market price. There was, however, another side to this experience. The poll tax in the two States named was almost a measure of necessity. Land was of small value, for there was in the new colonies little distinction between improved and unimproved lands. Slaves were not taxable as personal estate, but belonged to the land and figured as real property; and the personal estates of the planters were comparatively small. Polls were therefore the most available measure of taxation, and tobacco was the currency of the day. All bills and charges were made out in so many pounds of tobacco; all lawyers' and court fees were so determined; the parish and county levies were fixed in weights of tobacco; and the minister drew as his salary so many pounds of tobacco from each parishioner, without respect to the market value of the crop. It accordingly happened that a poll levy might be excessive one year and nominal the next; with lawyers, ministers, and clerks rejoicing in abundant means one season and reduced to starvation point the next. Unequal, in proportion to wealth of the payer, as such a poll tax was, its inequality was furthermore greatly aggravated by fluctuations in the exchangeable value of the medium in which it was payable.

During the colonial period also, in North America, men's persons were included in the schedules of property made in reference to taxation; and instead of having a fixed sum, as was subsequently the rule in assessing a poll tax, the value of the poll was rated according to the earning capacity of the individual; and if he was old and infirm, or in any way disabled, the value of the poll was placed at a small amount.

Possibly by reason of English and American colonial experiences, and perhaps from an infiltration as it were, down through

the ages, of the fact that in Greece and Rome the poll tax was exacted only of the people of subjugated provinces, and was therefore regarded as a mark of inferiority or slavery, this tax in modern times has not been in accord with public sentiment, and in most countries has now been abandoned. The last poll tax in England was enacted in 1689. Like all its predecessors, it was always unpopular and was regarded as unsuited to the people of England. It was repealed in 1698, and "henceforth this form of tax passed into the list of taxes tried and never again to be imposed in England. What minister," said Henry Fox in 1748, "would presume again to suggest the hated hearth money of the Stuarts, or the poll taxes of the reign of William III?" (Dowell, Taxation in England, vol. ii, p. 49.)

In the United States the poll tax formed, in 1895, a part of the tax system of twenty-six of the States and Territories, and was not recognized in twenty others, and in some of the latter its levy is prohibited by constitutional provisions. In New York a general law for the incorporation of villages confers upon its trustees the power to raise money by levying a poll tax.

From a theoretical or purely economic point of view the present popular opposition and adverse sentiment to the poll tax in the United States do not seem to be warranted by any very good reasons. The arguments made use of by those opposed to its continuance are not derived from old-time precedents, or warranted by the experience of foreign countries, inasmuch as its assessment in the States of the Federal Union has always been inconsiderable in amount, and has rarely involved in its collection any inquisitorial or arbitrary measures. The one most deserving of attention has been, that it practically imposed a property qualification upon the right of suffrage by making its payment a prerequisite to the act of voting, a money payment of even so small a sum as two dollars per annum in Massachusetts and one dollar in Connecticut being regarded in that light. But in answer to this it may be said that paupers are disfranchised not because they are vicious or illiterate, but, because of their inability to support themselves or aid in supporting the State, it is held that they ought not to be allowed a voice in the government of the State. To be consistent, therefore, the advocates of the abolition of the poll tax as administered in New England ought also to connect with it—i. e., its abolition—an extension of suffrage to the inmates of poorhouses who, otherwise qualified for its exercise, are now debarred from it exclusively by a lack of property qualification. On the other hand, a leading argument in favor of its continuance is that the majority of citizens who pay no direct State taxes upon property of any kind, but who are self-supporting and not paupers, ought not to be exempt from *directly*,

contributing to the support of the government, and this argument may be amplified and illustrated as follows: Thus, there is no citizen, be he ever so humble, who is not vitally interested in the preservation and welfare of the civil society of which he is a member; and it is of the first importance, more especially as the tendency of the age seems to be antagonistic, that each member of society should be encouraged to realize at all times his personal interest in the well-being of the State. To the rich man society comes and exacts a contribution in some proportion to his means, and as a consequence he has inducements to directly interest himself in the fiscal management of the government. To the poor man, who is otherwise rarely *directly* confronted with the tax gatherer, society comes also, and, in common with all citizens of a certain age, asks a very small annual contribution for the support of the State, because each citizen is interested in its existence and welfare, has a measure of responsibility resting upon him, and should be made to realize that responsibility. In the fact, therefore, that the poll tax touches directly every citizen and is an effective agency for awakening him to a sense of his political duties and responsibilities, and so better qualifies him for the exercise of the right of suffrage, is to be found the true reason for the incorporation of a small annual poll tax into every correct system of State taxation.

As has already been pointed out, a poll tax, having regard solely to the person and not to his property, is the only tax to which the term *personal* can be rightfully applied. It is the essence also of every free and just government that every person —the most humble as well as the most exalted—is equal before the law, and has a right to invoke the sovereignty of the State in all its fullness for the protection of his person. Keeping these two points in view, it would further appear that a poll tax assessed equally upon all citizens, and free from all discrimination, represents the most perfect equality of service, and is the only tax which a citizen can pay which can be regarded in the light of a *reciprocal* for the service which the State renders to him in protecting his person, all other taxes being in respect to property or business.

As the Constitution of the United States also excludes from representation "Indians not taxed," it would seem to imply that its authors regarded the exercise of suffrage by a citizen that was not a pauper and paid no direct tax, as an anomaly not likely to occur under a government founded upon equal public rights and responsibilities, and also that a citizen who did not pay any direct tax to the State was not likely to have any more correct idea or measure of his true relation to the State than a wild Indian.

If, however, public sentiment in any community is so adverse to the levy of moderate poll taxes that their collection is not and can not be enforced with any degree of uniformity and equality, as is reported to be the case in many States, then the advisability of their abandonment can not well be questioned, for the want of respect for all law, which always results from the maintenance upon the statute book of any law which a community will not regard or permit to be enforced, is an evil that far outweighs any possible good that can come from its continuance. Furthermore, the statement is probably warranted that in no instance in history has it been possible to enforce a permanent tax against which by common consent the public has revolted.

In considering the feasibility of its continuance it should not be overlooked that the tax upon property can be collected because the State holds a confiscatory power over the property to the extent of the tax. But the tax upon the non-property-holding polls can not be collected except through the consent of the assessed person, unless resort is had to the old law of imprisonment until payment is made—a remedy not likely to find favor.

The recent experiences of Massachusetts and Pennsylvania are especially worthy of note in this connection. The Constitution of Massachusetts, adopted during the Revolution, limited the suffrage to "every male inhabitant of twenty-one years of age and upward, having a freehold estate within the Commonwealth of the annual income of three pounds, or any estate of the value of sixty pounds." This restriction was abolished in 1821, but payment of a poll tax was still required before a man could vote. In recent years, however, this form of taxation has become so unpopular in this State, mainly by reason of a general belief that politicians, without distinction of party, were in the habit of collecting and disbursing large sums for the purpose of influencing or bribing voters by payment of their poll taxes, that in 1891 an amendment to the Constitution of the State was adopted which, while retaining the previous obligation of the payment of an annual poll tax, abolished such payment as a prerequisite for voting. The result was that before the adoption of this amendment from fifty-two to fifty-nine per cent of the poll tax due in the city of Boston was collected year by year; but since then the percentage of collection has fallen below forty-four per cent. Many of the city's own employees figure among the delinquents, and it has been found necessary to place hundreds of poll bills in the hands of the city treasurer for the deduction of the amount due from their wages. Leaving out the persons who can not pay without great sacrifice, it is stated that Boston is still losing above one hundred thousand dollars yearly in revenue from failure to collect the taxes upon polls that can and should pay. And this, in a

modified form, is probably the situation throughout the State of Massachusetts.

In Pennsylvania the State Constitution makes the payment of a State or county tax, at least one month before election, a prerequisite to the exercise of suffrage; and as the poll tax involves the smallest amount of tax that a citizen could pay, it was expected that almost every man would pay it. But, in point of fact, it was found that thousands of citizens neglected to do so, and the political campaign committees, irrespective of party, recognizing this fact, have adopted the policy of furnishing voters whom they desired to influence with receipts for the payment of their poll taxes; and this practice has attained to such magnitude in recent years, that the two leading party organizations in the city of Philadelphia alone purchased in the year 1894 over ninety-five thousand such receipts. Obviously this is a form of bribery which is forbidden by the spirit if not by the letter of the law; and to meet such a situation of affairs the Legislature of Pennsylvania has recently (1897) enacted a law forbidding the payment of a poll tax by any other person than the elector against whom such tax is assessed.*

Neither of the judicial authorities above referred to seem to have grasped the great principle essential to the continuance of every truly free state—that the power of taxation should not be invoked for police purposes, but be strictly limited to the raising of revenue to meet legitimate state expenditures.

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* During the American colonial period some attempts were made to compel the exercise of suffrage by imposing a fine on citizens neglecting to vote at regular elections; the fine imposed in Maryland on citizens in default of such action having been one hundred pounds of tobacco. But since the adoption of the Federal Constitution no legislation of like character is believed to have taken place in any of the States until 1889, when Kansas City adopted a charter provision imposing a tax of two dollars and a half on each citizen who should fail to vote at a general election. This provision coming up for review before the State courts of Missouri, was affirmed in the first instance by a Superior Court judge, who took the ground that "in the enlightenment of the present age it is in the power of the State to compel its voters to exercise the election franchise, and if the State can do so the city is invested with the same power." After enumerating many things of an arbitrary nature that are done to maintain good municipal government, the judge said that he could see no legal objection to the use of the taxing power for the purpose of securing a full and perfect expression of public sentiment and the election of competent and worthy men to public offices. The position was an advanced one, he admitted, but not an unreasonable one, in view of the fact that "the highest type of government is attained when every voter casts his vote, and that vote is counted just as it is cast." On an appeal to the Supreme Court of the State, the provision was, however, declared unconstitutional, the language of the decision being as follows: "Taxes may be levied," it said, "in money or in services having a money value to the public, and he who pays in money does not necessarily have to pay more or less than he who pays in services, and *vice versa*, and it is upon this principle that these taxes are upheld; but who can estimate the money value to the public of a vote? It is degrading to the franchise to associate it with such an idea. The ballot of the humblest in the land may mold the destiny of the nation for ages."

"The man who will not buy a tax receipt, but expects his party to purchase it for him, is a bad citizen. He is, in effect, a person who is bribed, and who holds the value of his vote at a very small sum."—*Philadelphia Times.*

Of other terms employed to indicate different forms or methods of taxation, and a clear understanding of the meaning of which is essential to any correct discussion of the subject, the following are the most important:

DIRECT AND INDIRECT TAXES.—Taxes are generally characterized or classified as being either *direct* or *indirect;* but these terms, although in common use, are somewhat indefinite, owing to the inability of economists to agree as to their exact meaning; while in the United States this indefiniteness has been increased by the circumstance that its Supreme Federal Court has felt compelled by the language of the Federal Constitution to assign to the term "*direct,*" as applicable to taxation, a "*legal*" rather than an *economic* definition.

In a general sense the term *direct* is applied to those taxes which are demanded from the particular persons whom it is intended or desired shall pay them; and *indirect* to those which are demanded from a person with the expectation and intention that he shall indemnify himself for payment of the same at the expense of some other person.* There is, furthermore, a marked distinction, founded on sound philosophy, between a direct and indirect tax, which, if concisely expressed, will constitute two unimpeachable definitions. Thus an *indirect* tax, whoever may first advance it, is paid voluntarily and primarily (in the sense of ultimately) by the consumer of the taxed article. On the other hand, *a direct tax has always in it an element of compulsion;* not necessarily on the person who advances the tax in block, but on the person who is compelled to use or consume the taxed property

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* "In the assessment of indirect taxation, and such as is intended to bear upon specific classes of consumption, the object itself is alone attended to without regard to the party who may incur the charge. Sometimes a portion of the value of the specific product is demanded at the time of production—as in France, in respect to the article of salt. Sometimes the demand is made on entry, either into the State, as in the duties of import; or into the towns only, as in the duties of entry. Sometimes the tax is demanded of the consumer at the moment of transfer to him from the last producer—as in the case of the stamp duty, and the duty on theatrical tickets in France. Sometimes the Government requires a commodity to bear a particular mark, for which it makes a charge—as in the case of the assay mark on silver and a stamp on newspapers. Sometimes it monopolizes the manufacture of a particular article or the performance of a particular kind of business—as in the monopoly of tobacco and the postage of letters. Sometimes, instead of charging the commodity itself, it charges the payment of its price—as in the case of stamps on receipts and mercantile paper. All these are different ways of raising a revenue by indirect taxation; for the demand is not made on any person in particular, but attaches upon the product or article taxed."—*M. Jean Say, Treatise on Political Economy, 1821.*

or its product. For example, there is nothing compulsory or unequal in an ordinary license tax. If the license is high, no one is compelled to engage in a business covered by its legal requirement; and few persons will until the average profits of the taxed business by the regular laws of competition finally reach the average profits of other like employments or investments. A tax on commodities like whisky, tobacco, fermented liquors, oleomargarine, playing cards, dice, and the like, can always be avoided as a primary tax, or can be paid at discretion. But there is nothing voluntary in the payment of a tax upon *all* real or personal property, or on the income of such property. Human beings can not subsist without some forms of personal property, and therefore a tax upon all personal property or its income is of necessity compulsory and not voluntary. Any general assessments of personal property on or by reason of its income, as well as assessments on real estate, are unavoidable in their nature, and therefore, from a philosophic or economic point of view, are typically direct taxes. (See Alexander Hamilton's brief in the Carriage case, Hamilton's Works, vol. vii, p. 848.)

The presence or absence of the principle of compulsion as constituting the essential difference between a direct and an indirect tax has not, it is believed, been before recognized by economists. And yet it is clearly involved or comprised in the definitions given by acknowledged authorities on the subject. Thus M. Leroy Beaulieu, in his *Traité de la Science des Finances*, characterizes those taxes "as direct which the legislator intends should be *paid at once* and immediately by him who bears their burden. They strike at once his fortune or his revenue, and every intermediary between him and the treasury is suppressed." McCulloch (Principles of Taxation) describes a tax "to be direct when it is *immediately* taken from property," and *indirect* "when it is taken from its owners by making them pay for liberty to use certain articles or exercise certain privileges." M. Say defines a direct tax to be the "*absolute demand* of a specific portion of an individual's real or supposed revenue." (Political Economy, p. 461.)

In the assessment of direct taxes a proportionality is generally sought between the person who pays and the value of his property, or ability to pay. Thus, in the taxation of watches, which are popular subjects for direct taxation, the proportionality between the owner who pays and the amount of property rated is recognized and maintained, by imposing, as in the city of Philadelphia, a tax of one dollar on watches of gold and one of seventy-five cents on watches of silver. In the assessment of indirect taxes the maintenance of any proportionality between the taxpayer and his fortune is not regarded. The idea of a *personal* assessment, which is characteristic of direct taxes, furthermore

does not apply to indirect taxes, and the person upon whom the incidence of such taxation primarily falls may be regarded as advancing rather than paying the tax, which is ultimately paid by a consumer, not as a tax, but as a part of the market price of a commodity.

In other words, the general effect if not the avowed object of an indirect tax is to place its burden in a roundabout way on the person who ultimately bears it. Taxes on imports, or customs dues; most internal revenue taxes; "octroi" taxes, or taxes levied by municipalities on commodities—mainly articles of food—brought within their limits from without; stamps and fees for registering or verifying documents, are typical examples of indirect taxation.

The objections to this form of taxation are so great as to warrant their characterization as evils. In the *first* place, they prevent the taxpayer from knowing what he pays, by mixing up the price of an article with the tax, as has been already noticed. *Secondly*, they enhance the cost of a commodity to the consumer to a degree (often largely) in excess of the original burden of the tax. Thus, if an importer of sugar, salt, wool, coal, or metals pays taxes on these commodities when they enter the territory of another country (as, for example, that of the United States), he adds them to the first or invoice cost of the importation. On this aggregate he calculates and adds interest and profits when he sells to a wholesale dealer; and this process is repeated by every smaller dealer or retailer through whose hands the commodities pass on their way to final consumption; and as the number of such intermediaries is greatest in the case of articles sold by small retailers, the final burden of the tax is greatest on the very poor, whose necessities compel them to buy in very small quantities.* There is thus a very real and close connection between indirect taxation and pauperism.

In dealing with the relative influence of direct and indirect taxation, Mr. Gladstone, when Chancellor of the Exchequer, took the position in a parliamentary discussion in 1859 that "the distinction between them involves the question between rich and

* Some years since, at the instance of the writer, the late Charles L. Brace instituted an examination to determine the difference in price to individual consumers of coal bought in comparatively large and small quantities. He reported that as a rule, when coal could be delivered at private residences in the city of New York (at the time when the investigation was made) for four dollars and a half per ton, its cost to the people whose poverty compelled its purchase by the "bucketful" was at least twelve dollars per ton. And yet when subsequently a philanthropic capitalist proposed to remedy this grievance of the poor by selling coal bought in small quantities at greatly reduced rates, his attempt did not meet with the full approval of the people whom he desired to serve, by reason of an inference by them that the project must in some way be a scheme for the promotion of private gain rather than public good.

poor. All classes pay indirect taxation: the middle and wealthy pay direct; but indirect taxes press much more seriously on the laboring population."

An instructive comparison of the method and influence of direct and indirect taxation may be instituted by supposing the two systems to be put into practical operation under similar circumstances, for effecting a purpose which all are willing to admit is most desirable or necessary. For example, a town meeting is held to provide means for building a bridge. The direct and honest way would be to assess and levy an equitable tax, adequate to provide for the proposed expenditure, on the property of the citizens of the town. An indirect way, as exemplified by the tariff (omitting the complicated machinery for appraising merchandise), would be to provide that the storekeepers of the town should charge, on account of the proposed expenditure, an excess over general prices to the extent of two cents a pound on sugar, twenty-five cents more per yard on woolen cloth, five cents more for each tin pail or cup, and, keeping an account, return the results of the extra prices paid on the above-mentioned and other like commodities by their consumers, to the town treasury. Would it not be evident that under such a method of procedure the wealth of the town would in a great degree escape taxation for the construction of the bridge, and that its expense and burden would fall mainly upon the poor; inasmuch as the average amount of consumption of sugar, cloth, and tin by the citizens of the town, and the average *per capita* taxation contingent on the same, would have no just or uniform relation to their ability to pay for the same? A man with ten thousand a year income will not probably consume ten times as much sugar as one with one thousand a year.

In the case of imported commodities charged with import duties, not only is the price of the imported commodity enhanced directly by the duty, but the price of a much larger quantity of competing product of domestic origin is increased to approximately the same extent. Thus, in the case of iron and steel, the average difference in the prices of these commodities in England and the United States during the ten years from 1878 to 1887 inclusive, occasioned by the imposition of indirect customs taxes by the latter country on such a comparatively small proportion of its domestic consumption as was imported, increased the cost of the *total* consumption of these products in the United States during the period mentioned, to the extent of at least $550,000,000. Such an increase represented an average of $55,000,000 per annum in excess of the cost of a like quantity to consumers in Great Britain during the same period; an aggregate, according to the census data of 1880, in excess of the entire capital invested in the

iron and steel industries of the country, including all its mines of both coal and iron.

An incident also illustrative of the character of an indirect tax was afforded some years ago when it was proposed in Washington to ex-Governor Warmoth, of Louisiana, as representative of the sugar-producing interest of that State, to substitute a bounty on domestic sugars in place of the protection afforded by the then tariff (taxation) on the importation of foreign sugars. The suggestion was repelled with no little warmth, on the ground that such a substitution would be most prejudicial to the domestic sugar industry. "The people," he said, "know that a bounty is a tax, and as soon as they found out its amount would insist upon its repeal, and thus the sugar interest would lose both the protection of the tax on foreign competitive imports as well as the bounty." How far subsequent events harmonized with this forecast by Mr. Warmoth is worthy of brief notice in this connection. Congress in 1891 entirely repealed all the tariff (tax) on the importation of raw sugars, and to compensate the domestic producers of sugar for the abrogation of the protection which had been previously given them, authorized the payment by the Federal Government of a bounty of from one and three fourths to two cents per pound on their product. In a little more than four years subsequently, when the effect of the bounty—aggregating over $30,000,000 and representing nearly the whole cost of producing the sugar entitled to bounty—had been fully recognized by the public, Congress repealed the act authorizing its payment without restoring the former protective duties; and with such a pronounced approval of its action on the part of the people of the United States as to render it almost certain that no Congress will hereafter authorize the direct payment of bounties by the Federal Government for any purpose.*

THE RELATIVE BURDEN ON TAXPAYERS OF DIRECT AND INDIRECT TAXATION.—Any discussion of this subject would be incom-

* The fundamental question involved in this sugar-bounty matter has never been passed upon directly by the Supreme Court of the United States; but the disbursement of the money voted by Congress for the payment of the sugar bounties having been withheld by the Comptroller of the United States Treasury on the ground that the appropriation was unconstitutional, the case came up before the United States Court of Appeals of the District of Columbia, which sustained the opinion of the Treasury official, and was adverse to the claim that "the general welfare" clause of the Constitution might be stretched to encourage the production of a commodity by a bounty. "If to Congress be conceded," it said, "the power to grant subsidies from the public revenues to all objects it may deem to be for the general welfare, then it follows that this discretion renders superfluous all the special delegations of power contained in the Constitution, and opens a way for a flood of socialistic legislation, the specious plea for all of which has ever been 'the general welfare.'" For further notice of this celebrated case see Chapter VII, Popular Science Monthly, p. 518.

plete that failed to notice the estimates of the relative burden on taxpayers of direct and indirect taxation by persons well qualified by study, and administrative tax experience, to express an opinion.

It is not a matter of dispute that the cost of collecting direct taxes is, as a rule, much less than is the case with indirect taxes, and that of the receipt contingent on the former the largest proportion accrues to the Government. Thus in Prussia, where the administration of taxation may be characterized generally as despotic, the cost of raising revenue from direct taxes has been reported at four per cent and of indirect at twelve per cent. Under a direct tax system everybody knows how much he really pays, and if he votes for war or any other expensive national luxury, he does it with his eyes open to what it costs him. If all taxes were direct, taxation would be much more apparent than at present, and there would be a continuous popular demand, which at present there is not, for economy in public expenditures.

In England it has been estimated that for every *fifty* millions of indirect taxes paid into the exchequer, *seventy* millions are finally taken from consumers; and M. Guyot, late French Minister of Public Works, has recently shown by a series of statistical diagrams, that the *octroi* system of indirect taxation in France adds on an average twenty per cent to the cost of goods to consumers over and above the tax.* In New Zealand, where a comparatively small population and limited and definite sources of revenue have afforded extraordinary facilities for making an analysis, an expert has recently calculated that for every million and a half collected through the customs the people of that colony have paid not less than a million and two thirds.

In 1851 a committee of the Liverpool (England) Financial Reform Association published a statement, that a careful investigation instituted by it showed, that the difference between the net amount paid into the exchequer from indirect taxes and the gross amount taken through or in consequence of this system from the taxpayers, was not less than an average of thirty-seven per cent; and added that the evidence that had led to this conclusion "can neither be controverted as matter of fact, nor strengthened as a matter of argument."

In 1846 Hon. Robert J. Walker, then Secretary of the Treasury, in accordance with instructions from the United States Senate to report the extent to which the price of domestic products was enhanced by the then existing duties imposed on the import of

* It seems incredible, he is reported as graphically saying, "that Frenchmen, usually so sensitive to ridicule, can quietly submit to be 'sweated' and 'plucked' like fowls, without crying out against this antiquated method of indirect taxation only so long as they are kept blind to the tax."

competing commodities, submitted the following statement: "The revenue from imports last year exceeded twenty-seven millions of dollars, of which, twenty-seven millions are paid to the Government upon imports, and forty-four millions in enhanced prices of similar domestic articles. This estimate is based upon the position that the duty is added to the price of the import and also of its domestic rival. If the import is enhanced in price by the duty, so must be its domestic rival, for, being like articles, their price must be the same in the same market." (Senate Document, First Session, Twenty-ninth Congress, 1845–'46.) *

In a debate in the Constitutional Convention of the State of New York in 1867–'68, the late Hon. George Opdyke, a member, and one of the best economic and fiscal authorities of his time, stated that his investigations had led him to the conclusion that consumers of imported articles in the United States are "charged with at least fifty per cent in addition to the duties actually received by the Government."

As the result of a careful study of the subject, based on the rates of duty imposed by the tariff law of March, 1883, Hon. William H. Springer (for a long time a prominent member of Congress) was led to the conclusion that the average increase in the prices of domestic commodities due to the duties imposed on the import of competitive products had not been less than $556,000,000 for every year of the twenty years next precedent to 1883, "making an aggregate of over eleven billions of dollars, not one dollar of which went into the national Treasury." (See North American Review, vol. cxxxvi, No. 319.)

The experience of the indirect taxation of commodities also shows that they favor the concentration of business in a few hands, or the creation of monopolies. Of this the experience of the internal revenue system of the United States has furnished some curious examples. Thus a tax was imposed in 1864 on matches at the rate of one cent per package of one hundred or less; and, although comparatively insignificant, it yielded at one time, by reason of the immense number of matches consumed, an annual revenue of over $3,500,000, which sum the manufacturer was obliged to advance by purchasing and affixing stamps to each package as a prerequisite to selling. To manufacturers furnishing their own design for the stamp, the Government allowed a discount of ten per cent on stamps of an aggregate value in excess of five hundred dollars purchased at any one time, and sixty days' credit to such manufacturers as could offer satisfactory security

* This estimate was founded on an apparently careful investigation of the prices "of sixteen leading domestic articles and the manufactures thereof, similar to those on which the present duties (1845) are imposed."

(i. e., in the form of United States bonds) for their payments. Under such circumstances small manufacturers with a limited capital were crushed, and the business of manufacturing concentrated in a very few firms, which raised the retail price of matches to an extent considerably in excess of the amount of the tax. In later years (1883), when it was proposed to repeal this tax, the singular spectacle was afforded of the larger manufacturers strenuously exerting themselves to influence Congress to prevent the repeal, and asking that they might continue to be taxed. Their efforts were, however, unavailing. The tax was abolished, and the retail price of matches immediately declined more than fifty per centum—i. e., from fifteen cents to six cents for six boxes.

Many years ago the late Henry C. Carey characterized indirect taxation in the following forcible and figurative language: "The whole system of indirect taxation," he said, "is mere petty larceny. It is an attempt to filch that which can not be openly demanded. It is one of those 'inventions' of man by which the few are enabled to grow rich at the expense of the many, and is therefore greatly favored by that class of men who prefer living by the labor of others to living by their own. The man who plunders a city is of the same species with the highway robber. The one who imposes indirect taxes is of the same species with the *chevalier d'industrie*. All belong to the *genus* of great men. All are equally destitute of manly or generous feeling. The plunderer of cities selects those which are weak and defenseless, and the collector of indirect taxes selects the commodities used by poor men who can not defend themselves; and where the system most prevails, men are most weak and cheap and food most dear." * (H. C. Carey, Past, Present, and Future, pp. 464, 465, Philadelphia, 1848.)

* "So long as it (indirect taxation) shall be permitted to exist, depopulation, and the system of large revenues, raised by means of indirect taxation, to be squandered by those who live by managing the affairs of others, must continue. So long as it exists, the planter and farmer must continue to give a large portion of their small product in exchange for a small quantity of clothing. So long as it exists, every attempt at the establishment of freedom of trade must be a failure. With its correction, every obstacle to the establishment of perfect freedom will disappear, and the tariff will pass out of existence. The interest of every farmer and planter, and of every laborer and mechanic, is directly concerned in the adoption of a measure that shall be calculated to promptly produce the effect desired—i. e., repeal of indirect taxation—but it is not more his interest than his duty. So long as the present system shall continue, trade of every kind must be subject to violent fluctuations which enable the few to enrich themselves at the expense of the many, and enable gambling speculators to live in palaces and ride in coaches by aid of indirect taxation levied upon the hard-working mechanic and honest trader, ruined by changes in the value of their property. It is, therefore, the bounden duty of every man desirous to promote the great cause of morality, justice, and of truth, to unite his efforts with those of his neighbor for the early accomplishment of this great object."—*H. C. Carey, Past, Present, and Future, pp. 471, 472, Philadelphia, 1848.*

And yet Mr. Carey's name, more than that of any other citizen of the United States, is identified with a system of raising revenue which is based exclusively on indirect taxation.

Mr. Henry George, in one of his essays, also thus forcibly makes clear a leading characteristic of the indirect taxes levied by the Federal Government: "Propose," he says, "to abolish, or even reduce, one of these taxes, and Washington will be filled with lobbyists begging and working for its extension. What does this mean? It means that these taxes yield revenue to private parties as well as to the Government."

Carlyle was not far out of the way in characterizing legislators who advocate indirect taxation as having a purpose, "that those who are not hungry should suppress those who are. The pigs are to die—i. e., be subject to taxation—no conceivable help for that; but we, by God's blessing, will at least keep down their squealing!"

The question of the relative merits of the two systems of taxation under consideration, has long been—since the days of Jeremy Bentham—a subject of discussion, with a trend of popular sentiment unmistakably in favor of indirect, or it should rather be said in opposition to direct taxation.*

What satisfactory explanation can be given for a conclusion so clearly adverse to public interest? John Stuart Mill has attempted it as follows: "The feeling is not grounded on the merits of the case, and is of a puerile kind. An Englishman dislikes not so much the payment as the act of payment. He dislikes seeing the face of the tax collector and being subjected to his peremptory demand. Perhaps, too, the money which he is required to pay directly out of his pocket is the only taxation which he is quite sure that he pays at all. That a tax of two shillings per pound on tea, or of three shillings per bottle on wine, raises the price of each pound of tea and bottle of wine which he consumes by that and more than that amount can not

* "We find, as the result of our examination and contrast, that direct taxation is, in every essential feature, vastly superior to our present method; that the former accords with justice, economy, and all the other requirements of a sound policy; while indirect taxation violates every principle on which legislation should be based. It must be owned, however, that notwithstanding the weighty objections to the one and the economy and perfect fairness of the other, there are few of our citizens who are desirous of making the proposed change. Direct taxation is a phrase that grates on the nerves of all. Men start at its sound as though it was a portent of evil; something which had impressed them with deadly fear. They seem to regard it as deeply imbued with the spirit of tyranny, to say the least, if not as the most forbidding impersonation of that monster. So unpopular is this method of taxation, that an aspirant for public station or honors would as soon think of committing high treason as propose or advocate it; and if his ambition were bounded by the present, he would be right, for he could not more effectually destroy his popularity."—*Treatise on Political Economy, by George Opdyke.*

indeed be denied. It is the fact, and is intended to be so, and he himself is perfectly aware of it; but it makes hardly any impression on his practical feelings and associations, serving to illustrate the distinction between what is merely known to be true and what is felt to be so."

Mr. Mill also expressed the opinion that men's minds are so little guided by reason on this subject that if it was attempted to raise all the imperial revenue of Great Britain by direct taxation, the dissatisfaction on the part of the people at having to pay so much would be extreme.

Speaking on this subject in the House of Lords in 1860, the Earl of Derby said that "by making the whole revenue of the United Kingdom depend upon direct taxation the pressure would be so odious that wars would be avoided, because no party would incur the odium of carrying them on."

There can be no doubt that high direct taxes, making evident to the most unobservant citizen the excess of burden imposed upon him, have been the prime cause of the repudiation of public debts in the United States, and the arrest or ruination of internal improvements of great importance.

Mr. George Opdyke, in his Treatise of Political Economy, advanced the idea that the phenomenon of preference for indirect taxation in the United States might be accounted for in part by the fact, that the unjust manner in which taxes were levied by Great Britain on her American colonies engendered in the public mind of their people "a deep-seated hatred of every form of taxation; and the direct being its most visible or sensible form, it has been mistaken for the worst—an impression that was strengthened when the most unpopular of our Presidents (the elder Adams) recommended this policy, and when the opposing political party, seizing the occasion to profit by public prejudice, represented it as the worst form of tyranny." *

An economic phenomenon in connection with this subject goes far to support the idea that political economy can not be an exact science, inasmuch as it is largely or wholly based on human action, concerning which nothing certain and invariable can be

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*An acute economic student and observer writes as follows on this subject: "I have been very much struck by the apathy of taxpayers to the increase of taxes in their most direct form. Take Philadelphia, for example. Nearly every man owns a house there, and yet there seems to have been no objection to the grossest municipal extravagance, entailing heavier and heavier burdens every year. The city to-day levies about ten times as much per head as it did thirty or forty years ago. The exact figures would be easy to get, and would certainly point a moral adverse to your view that direct taxation is twin brother to public economy. I am inclined to look for an explanation to the fact that real estate values have steadily risen, so that after all the increase of taxation has been easily met."

predicated. Thus the argument and evidence are complete that it is not a wise, humane, or perhaps a moral policy for a state created or maintained for the purpose of promoting the interests of its people to adopt a system of indirect taxation for the raising of revenue; and, furthermore, that it is contrary to human nature for a people to desire or be willing to pay more for any service or commodity than it is intrinsically worth; or, what is the same thing, perform more work in return for the same than is a fair equivalent. And yet both governments and the people in all countries and at all times (including the present) have shown a preference for this system of taxation over any other.

One explanation of this curious inconsistency is as follows: It is and ever has been the aim of all governments to avoid responsibility and occasion for popular criticism in respect to their financial policy; and a direct tax is an annual reminder to their citizens or subjects of the burden of government, and prompts them to hold the government to a strict accountability. Under a free or popular form of government a general system of direct taxation would practically call for an annual judgment of the voters on the fiscal policy of an administration in power, and such a tightening of the purse-strings as would reverse such policy in case of its popular disapproval. But with a system of indirect taxation, as a tariff on imports, a government can undertake the most unnecessary and extravagant measures and obtain revenue sufficient to defray its contingent expenditures without general popular disapproval.

Indeed, the best defense that can be offered for the continued resort to indirect taxation is, that with the present large demands on the part of all civilized states for revenue to meet increasing fiscal obligations, mainly incurred for war expenditures, past and present, and the unwillingness of the people to pay direct taxes, it would be practically impossible to maintain the modern government without large contributions from people of limited resources; and that this purpose can only be accomplished by taxing them indirectly. On the other hand, it may be replied that if direct taxation was alone made the agency for obtaining revenue, unnecessarily large expenditures through the resistance of the masses would not be possible. In like manner, if the present indirect taxes levied on imports by the United States were to be replaced by direct taxes, collected in money or in kind from purchasers for final consumption, on whom the burden in both cases finally rests—if every person buying silk or sugar were stopped by a government tax gatherer at the door of the place of purchase and thirty per cent of his purchases taken in kind in one case and fifty per cent in the other in payment for taxes, it is safe to say that such a system would not continue operative any longer

than would suffice for the people, through legal methods, to compel its modification. One explanation—i. e., of inconsistency—on the part of the people who pay taxes is, that although the benefits derived from the institution of government (which practically can not exist without taxation) are of the first importance, they are not so very obvious, nor so striking, as to be readily recognized and appreciated by the masses, who are accordingly apt to look with complacence upon a direct (personal) demand for a tax in the light of a compulsory payment, for which no equivalent is returned. Indeed, this feeling is so strong that it has become an almost popular maxim in all countries that "there is nothing which a person so hates to do as to pay taxes," in case they are direct. But by the ingenious plan of taxing articles on which incomes are expended, rather than openly demanding a portion of the income itself, the amount of taxation is concealed from the mass of taxpayers, and its payment is made to appear in some measure voluntary. The indirect tax being generally advanced rather than paid, as has been already shown, in the first instance by the importers, the ultimate purchasers for consumption confound the tax with the natural price of the commodity. No separate demand being made upon them for the tax, it escapes their consideration, and the article which they receive seems the fair equivalent of the sacrifice made in acquiring it. Indirect taxes have also the advantage of being paid by degrees, in small portions, and at a time when the commodities are wanted for consumption, or when it is most convenient for the consumer to pay them." *

In the attempt, furthermore, of civilized rulers to maintain a civilized government over an uncivilized people, there seems to be no practical method of compelling such a people to help maintain a proper and desirable government except through a resort to indirect taxation. Thus, in British India, a country of low civilization, small accumulation of wealth, and under such climatic conditions as necessitate the minimum of clothing, shelter, and food, the only way by which the mass of the native population can be compelled to contribute anything whatever, apart from a tax on land in the form of rent, toward the support of a government whose beneficent and civilizing influence has become a matter of history, is by the taxation of salt, the consumption of which is a necessity to all, and the production and distribution of which can in a great measure be controlled.

In the British island and colony of Jamaica, populated mainly by emancipated blacks and their descendants (557,132 out of a total of 580,804 in 1881), who own little or no land, and consume

* J. R. McCulloch. Taxation and the Funding System.

little of food other than what is produced almost spontaneously, the problem of how to raise revenue by any form of taxation for defraying the necessary expenditures of the Government has been one of great embarrassment. For the year 1884 these expenditures averaged three dollars and forty cents per head of the entire population, and of this amount an average of about fifty cents per head could only be obtained from any internal taxation, and this mainly through the indirect agency of licenses and stamps, and not by any direct assessment. The balance of required revenue was obtained from a special tax on some set manufacture, and from export and import duties. A similar state of affairs in Mexico, heretofore noticed somewhat in detail (see vol. xlix, No. 1, pages 45, 46), would also seem to necessitate a resort to a system of indirect taxation.

It is interesting to note, in connection with this subject, that while the States and municipal governments of the Federal Union derive their revenues almost entirely from direct taxation, the national revenues flow almost wholly from indirect taxes on commodities or personal property.

Attention is here also particularly directed to a fact that has almost entirely escaped the notice of economic and fiscal authorities and writers, and that is the remarkable change that has taken place within the last fifty years in the British tax system, whereby, through an extensive substitution of direct for indirect taxation, the burden of tax incidence has been shifted to a great extent from the community at large to the propertied classes. Thus, in 1841–'42, indirect taxes yielded seventy-three per cent and direct taxes twenty-seven per cent of the total imperial revenue, but in 1895–'96 indirect taxes yielded fifty-two per cent and direct taxes forty-eight per cent. Is not the inference warranted, that in the change in the incidence of British taxation above noted is to be found at least a partial explanation of the remarkable and progressive increase, in comparatively recent years, in the consumption of the various commodities that enter into the living of the laboring classes of Great Britain, and is it not also singular that the above facts and their possible inference do not as yet seem to have attracted the attention of those most interested in social economics ?

[*To be continued.*]

THE Mazamas is the name of a society of mountain climbers organized on the summit of Mount Hood in 1894 for the promotion of mountain exploration, the protection of forests and scenery, and the acquisition and dissemination of knowledge concerning these things. The qualification for membership is the ascent of a recognized snow-cap peak. The meeting at which the society was organized was attended by 193 people, who ascended 11,225 feet for the purpose.

SUICIDE AND THE ENVIRONMENT.

By ROBERT N. REEVES.

IN the discussion of the increase of suicide in the United States, a great deal has been said in the consideration of the act as a crime, but little, comparatively, in reference to its causes or to those preventives which society has power to enforce. Dr. D. R. Dewey, who some years ago made a careful study of the question as it related to the New England States, declared that since the year 1860 suicide had increased in those States to the extent of thirty-five per cent. This percentage, with but slight variations, will probably apply to all other States of the Union where there is great industrial and commercial activity.

Suicide is so violent a reversal of that strongest instinct of Nature—the instinct of self-preservation—that its causes and preventives will always be the subject of deep and careful investigation. If it is on the increase, there must be causes for its increase, and these causes being ascertained, it is then our duty to devise means for its prevention. Insanity, heredity, financial reverses, and domestic complications may be direct incentives to suicide, but back of them all is the real cause—the growth of a nervous, disordered temperament in the American people. The steady habits of our colonial ancestors no longer satisfy us, and, as a consequence, those amusements, those ventures and schemes which excite the mind and nervous system to the highest degree are becoming more and more prominent. This, no doubt, is the fundamental cause of all suicide. But it is only with the direct incentive that society is capable of dealing, and these direct causes are so numerous and varied that it is almost impossible to classify them with any degree of accuracy. The individual may be impelled to self-destruction by circumstances, by an innate craving or instinct, by an uncontrollable impulse, by the unhealthy reasoning of a disordered intellect, and by many other influences. Suicides may therefore be divided into two great classes—those in which reason is called upon to decide between life and death, and those which are due to impulse or insanity. In the former class the self-destroyer has, after reasoning upon his condition, come to the conclusion that death is the most acceptable of impending evils. In this class may be placed all those suicides due to sickness, financial embarrassment, ungratified ambition, the desire to escape justice, and causes of a like nature.

Among the second class, or those self-murders which are the direct or indirect outcome of insanity, may be included all cases of persons who are impelled to destroy their lives when insane, of

those who commit the act on some trivial cause or provocation or from imitation, of those who while sane give way to sudden impulse, and of those who, after a longer or shorter struggle, succumb at their own hands to a growing impulse. Civilization, drunkenness, imitation, and hereditary propensities are accountable for much of the self-destruction prevalent; and so, to a greater or less extent, are age, sex, the state of health, and daily occupations of the victim.

Attempts have been made to prove that climate has an effect upon the rate of suicide, but these attempts have never done more than show that the temperate regions have the highest ratio. This, of course, is not due to the climate, but to the more complicated civilization, the greater physical and mental wear, and the more extensive interference with natural laws met with in the temperate regions. While it is true that climate exerts but little influence over the rate of suicide, the seasons, on the contrary, do strongly affect it. The popular belief is that suicide is more frequent during the months of winter and spring. This, however, is incorrect. Cold, wet, damp weather does not, as so many people suppose, promote despondency and suicide. Strange as it may seem, at that period of the year when the sufferings of the poor and the sick are least, when employment is most readily obtained, when the pleasure of living should be at its highest, suicide is most frequent. May, June, and July, the months of song and sunshine in all countries, give the greatest number of self-murders. For this there is no satisfactory explanation, unless we accept that of the medical fraternity, which is that during the period of early summer the organism is working at a higher tension, every function of mind and body is more active than at any other period of the year, and consequently there is greater liability to sudden physical and mental collapse.

The sad fact that suicide and education increase at an equal rate is now generally admitted. Civilization does not free humanity from grief, disgrace, and disappointment; but wherever civilization is highest the struggle for existence is fiercest, life is most artificial, and there the most failures of the human race are met with. There was a time in Roman history when suicide was almost epidemic. It was when the great republic had reached its acme of civilization—when poetry, art, and eloquence were triumphant. It is probable that the proportion of suicides due to mental derangements is increasing, but how rapidly can never be exactly determined. Morselli says that about one third of all suicides may be attributed to insanity.

Many people, however, anxious to stamp the act with reprobation, declare that every suicide is insane. This is wrong. While those who bring about their self-destruction may have acted

wrongly or unwisely, we have not the right to declare them all insane. It is true that many persons brood over their troubles until everything loses proportion, their minds become unbalanced, and in such a state they kill themselves. In such cases the act may be correctly attributed to insanity. But what are we to say of those who are to all appearance rational and yet are the victims of sudden or growing impulses? Such people are not voluntary agents, and yet they can not be called insane. They are abnormal. There is a fatal defect in their organization which is incompatible with their survival under natural conditions. This defect may give rise to sudden impulses or may cause a growing gradual propensity which terminate in the final tragedy. Instantaneous impulses are often brought about by the slightest circumstances. Thus, gazing steadily at the wheels of an approaching train or looking down from some great height may produce a delirium, a distention of the blood-vessels of the brain, that instantly paralyzes the will of the victim.

In the consideration of those propensities which are of gradual growth we are confronted with an extremely difficult problem. We know that a great many of those who ultimately destroy themselves fight for years against the impulse. How are we to account in such cases for the persistence of the tendency toward suicide, which seems to be a part of their nature, a part which draws them instinctively to death just as the normal creature is drawn to a desire to live? For such cases heredity may be in a great measure responsible. It is clear that hereditary influences may reveal their force in the suicidal impulses as in many other of the problems of life.

Whole families have been known to kill themselves. There are a great many human beings who by nature are predisposed to self-destruction, and only wait through life for a calamity sufficiently great to prompt them to the act. They are victims of their own faulty organizations.

Individual temperament may have a great deal to do with the question of suicide. In America the population is largely composed of the various European races, and although these are living under the same conditions, each nationality retains its own peculiar rate of suicide. Drink and crime are responsible for a large proportion of the daily self-murders. Drunkenness, the most active agent of degeneration known, is directly responsible for those which occur during a period of nervous depression following a debauch. Among the criminal classes suicide is quite common, but it is among the petty and not the grave offenders that it occurs. Poverty and disease are also strong incentives to self-destruction. Suicide is often regulated by the price of bread. Life has few pleasures for the homeless and friendless. Death to

them is often a welcome friend, a happy relief from walking the streets hungry.

How many suicides are directly attributable to disease can not be stated with exactness, but it may be said, nevertheless, that at the present time, with our advanced skill in surgery and medicine, suicide from disease is undoubtedly on the decrease. Of all suicides there are none to be pitied more than those who kill themselves to escape the racking pain of an incurable illness. For the victim of this sort there is no hope. Another class of suicides, which closely resemble those caused by disease, includes those due to infirmity. Often persons smitten with blindness, or who have met with some terrible accident, in a fit of discouragement kill themselves. Those blind or deformed from birth, however, seldom resort to suicide. Not knowing the pleasure of sight or limb, they go through life contented.

The theory that we hold more strongly to life as we approach its natural conclusion is contradicted by statistics, which everywhere show that the last half of life exhibits a great increase in the rate of suicide. And here it may be pointed out that as to the age of greatest frequency, suicide and crime are diametrically opposed. While suicide attains its highest rate after the prime of life is past, crime, on the contrary, reaches its highest point between the ages of twenty and thirty years. We remark, further, the alarming increase in late years of what is called child-suicide. It is here that education strongly asserts itself as a true and exciting factor, for it has been shown that in those countries where what we are pleased to call education is rigorously forced upon children, there child-suicide is most frequent. And for this system of forced education there is no excuse. It is terrible in its consequences. To increase the strain to just below the collapsing point is not to educate. It only serves to fill the world with nervous, neurotic, morbid beings.

Another cause of the increase of child-suicide is the fear of physical punishment. Instances of children destroying themselves because of punishment or the fear of threatened punishment are constantly recorded in the public prints. Repeated cruel punishments will often extinguish, even in the healthy child, the love of life so characteristic of youth. What, then, are we to expect of poor, devitalized children subjected to the cruelties of barbaric parents?

At the present day man is much more prone to suicide than woman. This is true of man in regard to epilepsy, crime, and other marked signs of degeneration. But it has been observed that as woman approaches man in her mode of life she also becomes more familiar with those abnormal conditions which have previously been peculiar to man. The comparative immu-

nity of woman from self-destruction in the past has depended greatly upon the relatively less harassing part she has taken in the struggle for life. To-day it is different. Now woman occupies the fields of art, literature, finance, and even politics, and, as she goes deeper into these vocations, she must expect to suffer the consequences. Already it is noticeable that feminine suicide is not now entirely due to the sentimental causes of disappointed love, desertion, and jealousy, but to those trials of a more material order such as have led men to the act of self-destruction.

Imitation far exceeds any other of what are called "trivial causes" of suicide, and asserts itself more in woman than in man. It is much more common than is supposed. When self-destruction becomes epidemic, as it sometimes does, its prevalence very largely depends upon imitation. It is said that many years ago the wail of Thomas Hood over The One More Unfortunate brought many a sentimental person to a watery grave in the Thames. And in our own day the vivid representation of suicide upon the stage under conditions appealing forcibly to the imagination has been known to be followed by the self-imposed death of persons whose conditions resembled closely those of the suicide in the drama.

The daily papers are largely responsible for this class of suicides. It can scarcely be doubted that the general diffusion of newspaper reports familiarizes too much the minds of the people with suicide and crime. A single paragraph, a chance expression, a cause given which resembles that of the circumstances surrounding the reader, seizes the imagination, and in a morbid excitement the desire to repeat the act is born. Newspaper reports further promote suicide by inflaming the passion for the notoriety which will be conferred upon the perpetrator through their accounts of the act.

Has city life any influence over the proportion of suicides? This question must be answered in the affirmative. Where the population is dense and the laws of health are neglected, where dirt is common and vice flourishes, where the poor are concentrated, and where fortunes are made and lost in a day, will always be found the highest rate of suicide. It is in the poorer districts of our large cities that suicide is most frequent. In these districts the deprivations of light and air, the poverty, the diseased conditions about them, render the poor moody, morbid, and despondent, and raise in their minds a feeling that life is not desirable.

What can society do to prevent suicide among the poor? The obvious method would be to render their conditions more enjoyable by giving them ampler provisions for pleasure and recrea-

tion, making their surroundings more cleanly and agreeable, and by faithfully executing thorough and most effective sanitation. Proper sanitary and hygienic measures have a wonderful effect in renewing the vitality of our people. They are powerful agents for improving morality.

There probably never will be a time when suicide will be unknown in the world, but there are many preventives that are of value to-day. Religion has in the past been a powerful preventive. But this fear dies out as religion becomes broader. The fear of future punishment on account of self-imposed death is not now the preventive of suicide that it was fifty or a hundred years ago. The moral influences of family life naturally have a tendency to decrease suicide. Thus it has been found that in a million of husbands without children there were four hundred and seventy suicides, and in the same number with children there were but two hundred and five. Of a million wives without children one hundred and fifty-seven committed suicide, as against forty-five with children; widowers without children, one thousand and four; with children, five hundred and twenty-six; widows without children, two hundred and thirty-eight; with children, but one hundred and four. These figures are eloquent pleaders in favor of family ties as conservators of life. They prove distinctly that man must love in order to live.

Laws prescribing punishment for suicide are solecisms. If we wish to prevent suicide we must change conditions for the better, not for the worse. Suicide is beyond the reach of the criminal code. Its prophylactic must be founded, not upon a statute, but upon a wise and judicious management, medical, moral, and philanthropical, of those unfortunate enough to attempt their lives. It would be far better and more humane to sweep away all legislation upon the subject so far as it relates to the individual, and even take for granted that every person is insane who attempts suicide, than to punish their attempts by imprisonment. If the victim is insane, efforts should be made to restore reason; and if failure is met with, a sanitarium should be provided. Those who are sane should be reasoned with, calmed, and assisted.

Our hearts should be filled with tender compassion for those whose lives have been such as to become valueless to them. We should pity them. In the gentlest language possible we should condone and not condemn their act; for it is only with a spirit of sympathy and not of vindictiveness that we can hope to study with profit the causes and preventives of suicide.

THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(Lowell Institute Lectures, 1896.)

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V.—THE THREE EUROPEAN RACES.

IT may smack of heresy to assert, in face of the teachings of all our text-books on geography and history, that there is no single European or white race of men; and yet that is the plain truth of the matter. No continental group of human beings with greater diversities or extremes of physical type exists. That fact accounts in itself for much of our advance in culture. We have already shown in the preceding papers that entire communities of the tallest and shortest of men as well as the longest and broadest headed ones are here to be found within the confines of Europe. Even in respect of the color of the skin, hair, and eyes, responsible more than all else for the misnomer "white race," the greatest variations occur. To be sure, the several types are to-day all more or less blended together by the unifying influences of civilization; there are few sharp contrasts in Europe such as those between the Eskimo and the American Indian or the Malay and the Papuan in other parts of the world. We have been deceived by this in the past. It is high time for us to correct our ideas on the subject, especially in our school and college teaching.

Instead of a single European type there is indubitable evidence of at least three distinct races, each possessed of a history of its own, and each contributing something to the common product, population, as we see it to-day. If this be established it does away at one fell swoop with most of the current mouthings about Aryans and pre-Aryans; and especially with such appellations as the "Caucasian" or the "Indo-Germanic" race. Supposing for present peace that it be allowed that the ancestors of some peoples of Europe may once have been within sight of either the Caspian Sea or the Himalayas, we have still left two thirds of our European races and population out of account. As yet it is too early to discuss the events in the history of these races; that will claim our attention at a later time. The present task before us is to establish first of all that three such racial types exist in Europe.

The skeptic is already prepared perhaps to admit that what we have said about the several physical characteristics, such as the shape of the head, stature, and the like, may all be true. But he will continue to doubt that these offer evidence of distinct races because ordinary observation may detect such gross inconsisten-

cies on every hand. Even in the most secluded hamlet of the Alps, where population has remained undisturbed for thousands of years, he will be able to point out blond-haired children whose parents were dark, short sons of tall fathers, and the like. Our portraits of four Corsicans chosen at random offer a case in point. The people of this rocky island are as highly individualized as any in Europe. They offer the purest examples of the southern or Mediterranean type of Europeans; and yet these four men are quite different from one another. As the indexes show, the heads are quite unlike in their proportions. The man on the right is apparently broader-faced than either of the fellows next him, although he is relatively much longer-headed than either. The four vary considerably in the color of the hair and eyes. Nor in stature is there any greater apparent similarity. Such diversities

72·3. 80·8. 80·1. 75.

CEPHALIC INDEX OF CORSICAN PEASANTS.

confront us on every hand even in this retired corner of Europe. What may we not anticipate in less favored places, especially in the large cities ?

Traits in themselves are all right, our objector will maintain: but you must show that they are hereditary, persistent. More than that, you must prove not alone the transmissibility of a single trait by itself, you must also show that combinations of traits are so handed down from father to son. Three stages in the development of our proof must be noted: first, the distribution of separate traits; secondly, their association into types; and, lastly, the hereditary character of those types which alone justifies the term races. We have already taken the first step: we are now entering upon the second. It is highly important that we should keep these distinct. Even among professed anthropologists there is still much confusion of thought upon the subject—so much so, in fact, that some have, it seems to me without warrant, abandoned the task in despair. Let us beware the example of the monkey in the fable. Seeking to withdraw a huge handful of racial nuts from the jar of fact, we may find the neck of scientific possibility all too small. We may fail because we have grasped too much at once. Let us examine.

There are two ways in which we may seek to assemble our separate physical traits into types—that is, to combine characteristics into living personalities. The one is purely anthropological, the other inferential and geographical in its nature. The first of these is simple. Answer is sought to a direct question. In a given population, are the blondes more often tall than the brunettes, or the reverse? Is the greater proportion of the tall men at the same time distinctly longer-headed or otherwise? and the like. If the answers to these questions be constant and consistent, our work is accomplished. Unfortunately they are not always so, hence our necessary recourse to the geographical proof: but they at least indicate a slight trend, which we may follow up by the other means.

Let it be boldly confessed at the outset that in the great number of cases no invariable association of traits in this way occurs. This is especially true among the people of the central part of Europe. The population of Switzerland, for example, is persistently aberrant in this respect; it is everything anthropologically that it ought not to be. This should not surprise us. In the first place, mountainous areas always contain the "ethnological sweepings of the plains," as Canon Taylor puts it. Especially is this true when the mountains lie in the very heart of the continent, at a focus of racial immigration. Moreover, the environment is competent to upset all probabilities, as we hope to have shown. Suppose a brunette type from the south should come to Andermatt and settle. If the altitude exerts an influence upon the pigmentation, as we have sought to prove; or if its concomitant poverty in the ante-tourist era should depress the stature, the racial equilibrium is as good as vanished in two or three generations. It is therefore only where the environment is simple; and especially on the outskirts of the continent, where migration and intermixture are more infrequent, that any constant and normal association of traits may be anticipated. Take a single example from many. We have always been taught to regard the Teutonic peoples—the Goths, Lombards, and Saxons—as tawny-haired, "large-limbed giants." History is filled with observations to that effect from the earliest times. Our maps have already led us to infer as much. Nevertheless, direct observations show that tall stature and blondness are by no means constant companions in the same person. In Scandinavia, Dr. Arbo asserts, I think, that the tallest men are at the same time inclined to blondness. In Italy, on the other edge of the continent, the same combination is certainly prevalent.* Over in Russia, once more on the outskirts of Europe,† the tall men are again found to be

* Livi. Anthropometria Militare, pp. 74, 76. † Globus, vol. xlii, 1892, p. 337.

lighter complexioned as a rule. Dr. Beddoe asserts that in Britain it is more often true than otherwise.* But if we turn to central Europe we are completely foiled. The association of stature and blondness fails or is reversed in Bavaria, in Baden, along the Adriatic, and in upper Austria and Salzburg, as well as among the European recruits observed in America during our civil war. In Würtemberg alone have we assurance that the relation holds good.† It seems to me significant, however, that when the association fails, as in the highlands of Austria, where the environment is eliminated, as in lower Austria, the tall men again become characteristically more blond than the short ones. In this last case environment is to blame; in others, racial intermixture, or it may be merely chance variation, is the cause.

In order to avoid disappointment, let us bear in mind that in no other part of the world save modern America is such an amalgamation of various peoples to be found as in Europe. History, and archæology long before history, show us a continual picture of tribes appearing and disappearing, crossing and recrossing in their migrations, assimilating, dividing, colonizing, conquering, or being absorbed. It follows from this that, even if our environment were uniform, our pure types must be exceedingly rare. Experience proves that the vast majority of the population of this continent shows evidence of crossing. Thus, in Germany, of six million school children observed on a given day, not one half of them showed the simple combination of dark eyes and dark hair or of light eyes and light hair. In the British Isles it appears that over thirty per cent of persons measured have fair eyes and dark hair—in other words, that the hair and the eyes do not accompany one another in type. Of four hundred and eighty-six students of the Institute of Technology, sixty-five per cent of them were of this mixed type. Even among the Jews, less than forty per cent of them are characterized by the same tinge of hair and eyes; so that in general we can not expect that more than one third of the population will be marked by this simple and single combination. We need not be surprised, therefore, that if we next seek to add a third characteristic, say the shape of the head, to this combination of hair and eyes, we find the proportion of pure types combining all three traits in a fixed measure to be very small indeed. Imagine a fourth trait, stature, or a

* Stature and Bulk of Man in the British Isles, p. 171. The opposite is perhaps true in Scotland (Topinard, Eléments, p. 491).

† Ranke. Physische Beiträge zur Anthropologie Bayerns, p. 195 *seq.*; and Der Mensch, ii, p. 124. Ammon, in Sammlung gemeinverständlicher, wissenschaftliche Vorträge, Series V, vol. ci, p. 14. Mittheilungen der anthropologischen Gesellschaft in Wien, xxv, p. 70. Zeitschrift für Ethnologie, Supplement, 1884, p. 26. Baxter, *op. cit.*, vol. i, pp. 23, 38. Von Hölder, Zusammenstellung der in Würtemberg vorkommenden Schädelformen, p. 6.

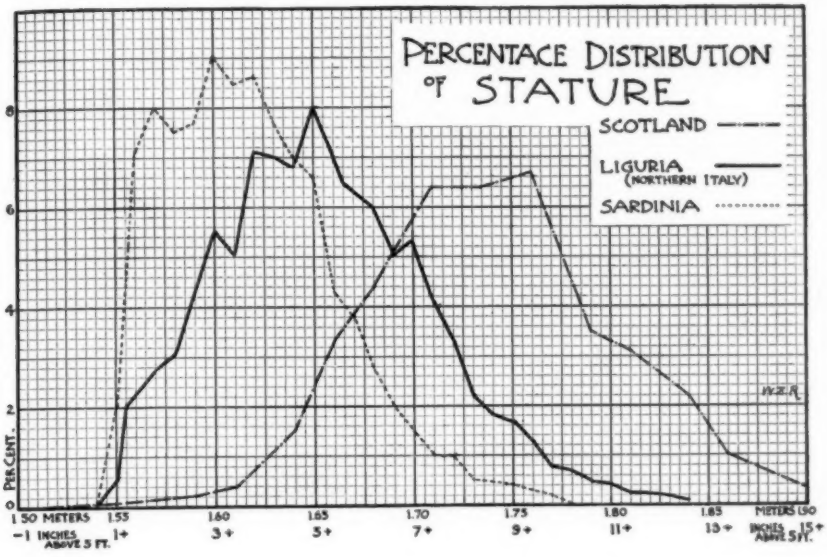
fifth, nose, to be added, and our proportion of pure type becomes almost infinitesimal. We are thus reduced to the extremity in which my friend Dr. Ammon, of Baden, found himself when I wrote asking for photographs of a pure Alpine type from the Black Forest. He has measured thousands of heads, and yet he answered that he really had not been able to find a perfect specimen in all details, as all his round-headed men were either blond, or tall, or narrow-nosed, or something else that they ought not to be.

Confronted by this situation, the tyro is here tempted to turn back in despair. There is no justification for it. It is not essential to our position that we should actually be able to isolate any considerable number, nor even a single one, of our perfect racial types in the life. It matters not to us that never more than a small majority of any given population possesses even two physical characteristics in their proper association; that relatively few of these are able to add a third to the combination; and that almost no individuals show a perfect union of all traits under one head, so to speak, while contradictions and mixed types are everywhere present. Such a condition of affairs need not disturb us if we understand ourselves aright. We should indeed be perplexed were it otherwise.

Consider how complex the problem really is! We say the people of Scotland are on the average among the tallest in Europe. True! But that does not mean that a great number of medium and undersized persons do not occur among them. We may illustrate the actual condition best by means of the accompanying diagram.* Three curves are plotted therein for the stature of large groups of men chosen at random from each of three typical parts of Europe. The one at the right is for the tall Scotch, the middle one for the medium-sized northern Italians, and the one at the left for Sardinians, the people of this island being among the shortest in all Europe. The height of each curve at any given point indicates the percentage within each group of men which possessed the stature marked at the base of that vertical line. Thus eight per cent of the Ligurian men were five feet and five inches tall (1·65 metres), while nine per cent of the Sardinians were fully two inches shorter (1·60 metres). In either case these several heights were the most common, although in no instance is the proportion

* The curve for the Scotch, taken from the Report of the Anthropometric Committee of the British Association for the Advancement of Science for 1883, has been arbitrarily corrected to correspond to the metric system employed by Dr. Livi in the other curves. A centimetre is roughly equal to 0·4 of an inch. It is assumed that in consequence only 0·4 as many individuals will fall within each centimetre class as in the groups of stature differing by inches. The ordinates in the Scotch diagram have therefore been reduced to 0·4 of their height in the original curve.

considerable at a given stature. There is, however, for each country or group of men some point about which the physical trait clusters. Thus the largest percentage of a given stature among the Scotch occurs at about five feet nine and a half inches. Yet a very large number of them, about five per cent, fall within the group of five feet seven inches (1·70 metres)—that is to say, no taller



than an equal percentage of the Ligurians—and even in Sardinia there is an appreciable number of that stature. We must understand therefore, when we say that the Scotch are a tall people or a long-headed or blond one, that we mean thereby not that all the people are peculiar in this respect even to a slight degree, but merely that in this region there are more specimens of these special types than elsewhere. Still it remains that the great mass of the people are merely neutral. This is a more serious obstacle to overcome than direct contradictions. They merely whet the appetite. Our most difficult problem is to separate the typical wheat from the noncommittal straw; to isolate our racial types from the general mean of the continent.

We have now seen how limited are the racial results attainable by the first of our two means of identification—that is, the purely anthropological one. It has appeared that only in the most simple conditions are the several traits constant and faithful to one another in their association in the same persons. Nor are we justified in asking for more. Our three racial types are not radically distinct seeds which, once planted in the several parts of Europe, have there taken root; and, each preserving its peculiarities intact, have spread from those centers outward until they

have suddenly run up against one another along a racial frontier. Such was the old-fashioned view of races in the days before the theory of evolution had remodeled our ways of thinking, when human races were held to be distinct creations of a Divine will. We conceive of it all quite differently. These types for us are all necessarily offshoots from the same trunk. The problem is far more complex to us for this reason. It is doubly dynamic. Upbuilding and demolition are taking place at the same time. By our constitution of racial types we seek to simplify the matter—for a moment to lose sight of all the destructive forces, and from obscure tendencies to derive ideal results. We picture an anthropological goal which might have been attained had the life conditions been less complicated.

Are we in this more presumptuous than other natural scientists? Is the geologist more certain of his deductions in his restoration of an ideal mountain chain from the denuded roots which alone bear witness to the fact to-day? In this case all the superstructure has long since disappeared. The restoration is no less scientific. It represents more clearly than aught else the rise and disappearance, the results and future tendencies of great geological movements. We take no more liberties with our racial types than this geologist with his mountains; nor do we mean more by our restorations. The parallel is instructive. The geologist is well aware that the uplifted folds as he depicts them never existed in completeness at any given time. He knows full well that erosion took place even as lateral pressure raised the contorted strata; that one may even have been the cause of the other. If indeed denudation could have been postponed until all the elevation of the strata had been accomplished, then the restoration of the mountain chain would stand for a real but vanished thing. This, the geologist is well aware, was not thus and so. In precisely the same sense do we conceive of our races. Far be it from us to assume that these three races of ours ever in the history of mankind existed in absolute purity or isolation from one another. As soon might the branch grow separate and apart from the parent oak. No sooner have environmental influences, peculiar habits of life, and artificial selection commenced to generate distinct varieties of men from the common clay; no sooner has heredity set itself to perpetuating these; than chance variation, migration, intermixture, and changing environments, with a host of minor dispersive factors, begin to efface this constructive work. Racial upbuilding and demolition, as we have said, have ever proceeded side by side. Never is the perfect type in view, while yet it is always possible. "Race," says Topinard, "in the present state of things is an abstract conception, a notion of continuity in discontinuity, of unity in diversity. It is the rehabilitation of a real

but directly unattainable thing." In this sense alone do we maintain that there are three ideal racial types in Europe to be distinguished from one another. They have often unfortunately dissolved in the common population; each trait has gone its own way; so that at the present time rarely, if indeed ever, do we discover a single individual corresponding to our racial type in every detail. It exists for us nevertheless.

Thus convinced that the facts do not warrant us in expecting too much of our anthropological means of isolating racial types, we have recourse to a second or inferential mode of study. In this we work by geographical areas rather than by personalities. We discover, for example, that the north of Europe constitutes a veritable center of dispersion of long-headedness. Quite independently we discover that the same region contains more blond traits than any other part of Europe; and that a high average stature there prevails. The inference is at once natural that these three characteristics combine to mark the prevalent type of the population. If one journeyed through it, one might at first expect to find the majority of the people to be long-headed and tall blondes; that the tallest individuals would be the most blond, the longest-headed most tall, and so on. This is, as we have already shown, too good and simple to be true, or even to be expected. Racial combinations of traits indeed disappear in a given population, as sugar dissolves, or rather as certain chemical salts are resolved into their constituent elements when immersed in water. From the proportions of each element discovered in the fluid, quite free from association, we are often able to show that they once were united in the same compound. In the same manner, we, finding these traits floating about loose, so to speak, in the same population, proceed to reconstitute types from them. We know that the people approach this type more and more as we near the specific center of its culmination. The traits may refuse to go otherwise than two by two, like the animals in the ark, although they may change partners quite frequently; and they may still manifest distinct affinities one for another nevertheless.

The apparent inference is not always the just one, although it tends to be. Suppose, for example, that one observer should prove that sixty per cent of ten thousand natives of Holland were blondes: and another, studying the same ten thousand individuals, should prove that a like proportion were very tall—would this of necessity mean that the Hollanders were mainly tall blondes? Not at all! It might still be that the two groups of traits merely overlapped at their edges. In other words, the great majority of the blondes might still be constituted from the shorter half of the population. Only twenty per cent need necessarily be tall and blond at once, even in this simple case where both observers stud-

ied the same men from different points of view. How much more confusing if each chanced to hit upon an entirely different set of ten thousand men! This, be it noted, is generally the case in practice. Nevertheless, although there is always danger in such inferences, we are fortunate in possessing so many parallel investigations that they check one another, and the tendencies all point in one direction.

These tendencies we may discover by means of curves drawn as we have indicated above in our diagram. By them we may analyze each group in detail. Every turn of the lines has a meaning. Thus, the most noticeable feature of the Sardinian curve of statures is its narrowness and height; the Ligurian one is broader at the base, with sloping sides; and the Scotch one looks as if pressure had been applied at the apex to flatten it out still farther. The interpretation is clear. In Sardinia we have a relatively unmixed population. Nearly all of the people are characterized by statures between five feet one inch (1·56 metres) and five feet five inches (1·65 metres). They are homogeneous, in other words: and they are homogeneous at the lower limit of human variation in stature. The curve is steepest on the left side. This means that the stature has been depressed to a point where neither misery nor chance variation can stunt still further; so that suddenly from seven per cent of the men of a height of five feet one and a half inches [more frequent than any given stature in Scotland] we drop to two per cent at a half inch shorter stature. A moment's consideration will show that the narrower the pyramid, the higher it must be. One hundred per cent of the people must be accounted for somewhere. If they do not scatter sidewise, their aggregation near the center will elevate the apex, or the shoulders of the curve at least. So that a sharp pyramid points to a homogeneous people. If they were all precisely alike, a single vertical line one hundred per cent high would result. On the other hand, a flattened curve indicates the introduction of some disturbing factor, be it an immigrant race, environment or what not. In this case the purity of the Sardinians is readily explicable. They have lived in the greatest isolation, set apart in the Mediterranean. A curve drawn for the Irish shows the same phenomenon. Islands demographically tend in the main to one or the other of the extremes. If unattractive, they offer examples of the purest isolation, as in Corsica and Sardinia. If inviting or on the cross-paths of navigation, like Sicily, their people speedily degenerate into mixed types. For if incentive to immigration be offered, they are approachable alike from all sides. The Scotch, as we have observed, are more or less mixed in type, and unequally subjected to the influences of environment; so that their curve shows evidence of heterogeneity.

Scotland combines the isolation of the highlands with a great extent of seacoast. The result has been that in including the population of both areas in a single curve we find evidence of impurity in the great variability of stature.

By the second geographical method which we have described, we constitute our racial types as the archæologist, from a mass of broken fragments of pottery, restores the designs upon his shattered and incomplete vases. Upon a bit of clay he discovers tracings of a portion of a conventionalized human figure. A full third—let us say the head of Thoth or some other Egyptian deity—is missing. The figure is incomplete to this extent. Near by is found upon another fragment a representation of the head and half the body of another figure. In this case it is the legs alone which lack. This originally formed no part of the same vase with the first bit. It is perhaps of entirely different size and color. Nevertheless, finding that the portions of the design upon the two fragments bear marks of identity in motive or design, data for the complete restoration of the figure of the god are at hand. It matters not that from the fragments in his possession the archæologist can reconstruct no single perfect form. The pieces of clay will in no wise fit together. The designs, notwithstanding, so complement one another that his mind is set at rest. The affinity of the two portions is almost as clearly defined as the disposition of certain chemical elements to combine in fixed proportions; for primitive religion or ornament is not tolerant of variation.

We copy the procedure of the archæologist precisely. In one population color of hair and stature gravitate toward certain definite combinations. Not far away, perhaps in another thousand men drawn from the same locality, the same stature is found to manifest an affinity for certain types of head form. It may require scores of observations to detect the tendency, so slight has it become. In still another thousand men perhaps a third combination is revealed. These all, however, overlap at the edges. Granted that an assumption is necessary. It is allowed to the archæologist. Our conclusions are more certain than his, even as the laws of physical combination are more immutable than those of mental association. For it was merely mental conservatism which kept the primitive designer of the vase from varying his patterns. Here we have unchanging physical facts upon which to rely. Of course, we should be glad to find all our physical traits definitely associated in completeness in the same thousand recruits, were it not denied to us. The archæologist would likewise rejoice at the discovery of a single perfect design upon a single vase. Both of us lack entities; we must be contented with affinities instead.

A final step in our constitution of races—that is, of hereditary types—is to prove that they are persistent; that like father like son corresponds to the facts in the case. Of direct testimony we possess nothing. No single investigator, save perhaps Galton, has to my knowledge followed down a line from one generation to another. Anthropologists are human themselves. The life of man is all too short to cover such tasks. But of indirect proof we have plenty. We know, for example, that in the north of Europe, as far back as archæology can carry us, men of a type of head form identical with the living population to-day were in a majority. Likewise the lake dwellers in Switzerland in the stone age, little more civilized than the natives of Africa, were true ancestors of the present Alpine race. Prehistoric archæology thus comes to our aid with cumulative proof that at all events traits are hereditary in populations, even if not always so in men. In truth, we here enter upon a larger field of investigation than the anthropological one. The whole topic of heredity opens up before us, too immense to discuss in this place. Suffice it to say that in the main no question is entertained upon the subject, save in the special cases of artificially acquired characteristics and the like.

After this tedious summary of methods, let us turn to results. The table on this page shows the combinations of traits into racial types which seem best to accord with the facts. It speaks for itself.

European Racial Types.

		Head.	Face.	Hair.	Eyes.	Stature.	Nose.	Synonyms.	Used by.
1	Teutonic.	Long.	Long.	Very light.	Blue.	Tall.	Narrow; aquiline.	Reihengräber. Germanic. Kymric. Aryan. (?) Homo Europæus.	Germans. French. Lapouge.
2	Alpine (Celtic).	Round.	Broad.	Light chestnut.	Hazel-gray.	Medium.	Variable; rather broad; heavy.	Celto-Slavic. Dissentis. Arvernian. Ligurian. Homo Alpinus.	French. Germans. Beddoe. Taylor. Lapouge.
3	Mediterranean.	Long.	Long	Dark brown or bl'k.	Dark.	Short. (?)	Rather broad.	Iberian. Ligurian.	English. Livi.

The first of our races is perhaps the most characteristic. It is entirely restricted to northwestern Europe, with a center of dispersion in Scandinavia. Our portraits, chosen as typical by Dr. Arbo of the Norwegian army, show certain of the physical peculiarities, especially the great length of the head, the long oval face, and the straight aquiline nose. The face is rather smooth in outline, the cheek bones not being prominent. The narrow nose seems to be a very constant trait, as much so as the

tendency to tall stature. Dr. Collignon has even demonstrated it as a law in France that the relation between the two holds good. The Teutonic race is also strongly inclined to blondness. The eyes are blue or light gray, and the hair flaxen, tawny, reddish, or sandy. The whole combination accords exactly with the descriptions handed down to us by the ancients. Such were the Goths, Ostrogoths, Visigoths, Vandals, Lombards, together with the Danes, Norsemen, Saxons, and their fellows of another place and time. History is thus strictly corroborated by natural science.

TEUTONIC TYPE. Norway, Vaage.
Cephalic Index, 75.

Our second racial type is most persistently characterized by the shape of the head. This is short and at the same time broad. The roundness is accompanied by a broad face, the chin full, and the nose rather heavy. These traits are all shown more or less clearly in our portraits, one from south central France, two from Bavaria, and one from northern Italy. The side views show the shortness of the

TEUTONIC TYPES. Norway, Hedalen.
Cephalic Index, 76.

head as contrasted with the Teutonic type above described. At the same time the cranium is high, the forehead straight, sometimes almost overhanging. It seems as if pressure had been applied front and back, the skull having yielded in an upward direction. This type is of medium height, decidedly inclined toward stockiness in build. Its whole aspect is rather of solidity than of

agility. The color of the hair and eyes is rather neutral, at all events intermediate between the Teutonic and Mediterranean

ALPINE TYPE. Auvergne, Central France.

races. There is a tendency toward grayish eyes, while the hair is more often brown. In these respects, however, there is great variability, and the transition to the north and south is very gradual. Climate or other environmental influence has in these

ALPINE TYPES. Bavaria.

traits eliminated all sharp division lines. These peculiarities appear only when the type is found in extreme isolation and purity.

What name shall we apply to this second race, characterized by its great breadth of head primarily, and which has its main

center of dissemination in the Alps. For the first three of our types the task of christening was simple enough. To name this second one would have been comparatively easy as well, if Cæsar had not introduced his Commentaries by the well-known passage: "All Gaul is divided into three parts, one of which the Belgæ inhabit; the Aquitani, another; those who in their own language are called Celts, in ours Gauls, the third." The so-called *Celtic question* is all involved in this simple statement. Let us reduce it to its lowest terms. The philologers properly insist upon calling all those who speak the Celtic language Celts. With less reason the archæologists follow them and insist upon assigning the name Celt to all those who possessed the Celtic culture; while the physical anthropologists, finding the Celtic language spoken by peoples of divers physical types, with equal propriety hold that the term Celt should be applied to that physical group or type of men which includes the greatest number of those who use the Celtic language. This manifestly operated to the exclusion of those who spoke Celtic but who differed from the linguistic majority in physical characteristics. The practical result of all this was that anthropologists called the tall and blond people of northern France and Belgium, Gauls or Kymri; and the broad heads of middle and southwestern France Celts: while Cæsar, as we saw, insisted that the Celt and the Gaul were identical. The anthropologists affirmed that the Celtic language had slipped off the tongues of some, and that others had adopted it at second hand. Their explanation held that the blond Belgæ had come into France from the north, bringing the Celtic speech, which those already there speedily adopted; but that they remained as distinct in blood as before. These anthropologists, therefore, insisted that the Belgæ deserved a distinctive name: and they called them Gauls, since they ruled in Gaul, in distinction from the Celts, who, being the earlier inhabitants, constituted the majority of the Celtic-speaking people. This was a cross-division with the philologists, who called the Belgæ Celts, because they brought the language, reserving the name Gaul, as they said, for the natives of that country; but

ALPINE TYPE. Piedmont, Northern Italy. Cephalic Index, 91·2.

both philologists and anthropologists alike differed from the historians, who held to Cæsar's view that the Gauls and the Celts were all one.

Still greater confusion arises if we attempt to discuss the origin of the people of the British Isles, where this Celtic question enters again. Thus the people of Ireland and Wales, of Cornwall and the Scottish Highlands, together with the Bretons in France, would all be Celtic for the linguist because they all spoke the Celtic language. For the anthropologist, as we shall see, the

ALPINE (SLAVIC) TYPES. Middle Russia.

Breton is as far from the Welsh as in some respects the Welsh are from the Scotch.

It happened that the father of modern anthropology, the illustrious Paul Broca, having pre-empted the term Celt for the people including most of the broad-headed type and its main crosses, all the anthropologists have followed him. The linguists have refused to yield their side, and still use the name in their own sense. We shall not seek to solve the question. If we have shown what confusion may result from the use of this term, we are content. Our own view is that the linguists and the archæologists are perhaps better entitled to the name *Celt*; but that they should be utterly denied the use of the word *race*. Be this as it may, we shall invent a new term, or rather adopt one from M. de Lapouge,

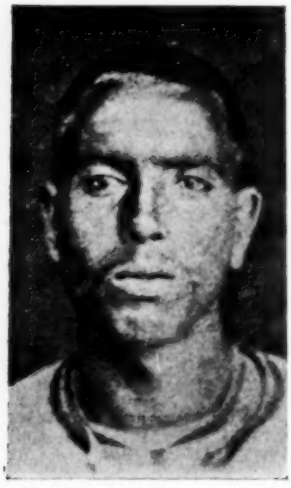
and call the broad-headed type Alpine. It centers in that region. It everywhere follows the elevated portions of western Europe. It is, therefore, pre-eminently a mountain type, whether in France, Spain, Italy, Germany, or Albania. By the use of it we shall carefully distinguish between language, culture, and physical type. Thus the Celtic language and the Aryan culture may spread over the Alpine race, or *vice versa*. As, in fact, each may migrate in independence of the others; so in our terminology we may distinctly follow them apart from one another. No confusion of terms can result. It is purely a geographical name, like the one we have applied to the third group.

MIXED ALPINE (ASIATIC) TYPE. Hungary.

One more matter of racial names remains for consideration. What shall we do with the term *Slavic*, which like Celtic is purely a linguistic or ethnological term? Curiously enough, from Poland to Macedonia, all over eastern Europe in fact, where the Slavic language is in common use, the people are of the same physical type as the Alpine race. The distinctive features, especially the broad-headedness, are somewhat attenuated, to be sure; but anthropologists are agreed that the two groups are identical. Our Russian portraits show the tendency in this direction. In eastern Europe, however, this type ceases to be identified with the mountainous areas. Its zone of extension is widespread over the plains. Shall we continue to call these people Slavs from their language, or assign them to the Alpine group despite this circumstance? Or shall we, as in recent vogue, apply the term Slavo-Celtic to the whole combination? The question is still further confused because the Slavic language linguistically is akin to the Teutonic, although the two physical types are as wide apart as the poles. If we reject our term Celt,

MEDITERRANEAN TYPE. Corsican. Cephalic Index, 72·3.

the other, being equally a linguistic term, should go as well. The only alternative seems to be to apply the term *Homo Alpinus* to this broad-headed group wherever it occurs, whether in mountains or plains, in the west or in the east. The name is justified by the circumstance that its main body occurs in the Alps, and that its purest types culminate there as well.



BERBER, TUNIS.
Cephalic Index, 72.

We now come to the last of our three races, which is generally known as the Mediterranean or Iberian type. It prevails everywhere south of the Pyrenees, along the southern coast of France, and in southern Italy, including Sicily and Sardinia. Once more we return to a type of head form almost identical with the Teutonic. Our portraits of Corsicans on a preceding page, with the enlargement of one of the four in the group, show the exaggerated length of face and the narrowness of the forehead. The cephalic index drops from eighty-seven and above in the Alps to about seventy-five all along the line. This is the primary fact to be noted. Coincidently, the color of hair and eyes becomes very dark, almost black. The figure is less amply proportioned, the people become light and rather agile. It is certain that the stature at the same time falls to an exceedingly low level: fully nine inches—more than a head—below the averages for Teutonic Europe. Authorities are, however, divided as to the significance of this. It has been shown that while the average height is low, a considerable number, and those of the purest type in other respects, are of goodly stature. It may indeed be that, as we have already suggested, too protracted civilization is responsible for this diminutiveness. The people of northern Africa (illustrated by our portrait), pure Mediterranean Europeans, are of medium size in fact. Personally I incline to the view that culture is to blame, and that the type is normally of

MEDITERRANEAN TYPE. Montpellier.
Cephalic Index, 67.

medium size, although it would be impossible of proof at this writing.

It would be interesting at this time to follow out the intellectual differences between these three races which we have described. The future social complexion of Europe is largely dependent upon them. The problem is too complicated to treat briefly. In a later paper, devoted expressly to modern social problems, we may return to it again. Our physical analysis is now complete. The next task is to trace the origin of nationalities from the combination of these elements. We shall begin with the French; for this single nation is, alone in all Europe, compounded of all three racial elements; nay, more, we shall be able to point to a still older population than any of these, living to-day in France, with an unbroken ancestry reaching back to the prehistoric stone age.

GLOBE LIGHTNING.

By M. HAGENAU.

OCCASIONALLY in thunderstorms peculiar electrical apparitions occur, similar in destructiveness to ordinary lightning, but by no means so transient. Their duration is measured, not by thousandths of a second, but by whole seconds or even minutes. They move so slowly that their progress can be accurately followed by the eye. As they generally appear in the form of glowing spheres, they are known as fireballs or globe lightning. The first account of this peculiar form of lightning was given by the celebrated English physicist, Robert Boyle, who described a ball which suddenly appeared on July 24, 1681, on the ship Albemarle. The sailors attacked it in vain with blows and water, but it burned itself out, leaving behind a strong smell of gunpowder.

In Boyle's time ordinary lightning flashes were thought to consist of inflamed gas, so that an occurrence like the above did not appear particularly striking, but later investigators were unable to make the fireball fit their knowledge and theory of electricity, and declared it to be a myth. A layman stated that such a ball appeared in his room during a storm and slowly made its way to the chimney. The scientific people asserted that it was an illusion of the senses, and that there were no such things as fireballs. But the balls continued to appear, in some instances being simultaneously seen by a number of trustworthy witnesses, so that their existence had to be admitted.

Let us notice a few well-attested recent cases:

Dr. A. Wartmann has given the Physical Society of Geneva

an account of a ball which he observed during a very violent storm on December 20, 1888, at half past six in the evening, while he was driving from Versoix to Genthod. As he passed the entrance gate of a large mansion he became aware of a very bright and persistent illumination, quite different from the intermittent light of the incessant lightning flashes.

Thinking it was a fire, he turned and saw, about one thousand feet away, a ball of fire some eighteen inches in diameter. It floated about half its diameter above the ground, and moved parallel with his own course with the swiftness of a hawk, leaving no trace behind it.

At a point about twenty-five yards ahead of him it burst with an appalling crash. "It seemed to me," the report concludes, "to throw out lines of fire. We felt a violent shock, and were blinded for several seconds. As soon as I could distinguish anything, I saw that the horses were standing at right angles to the carriage, with their heads toward the hedge. Their ears drooped, and they exhibited every symptom of intense fright." At the same time, a little less than a mile away, a farmer found himself surrounded by a violet light. He heard a loud explosion, and was thrown bodily ten feet, alighting on a piece of soft turf, more frightened than hurt.

On July 1, 1891, a fireball entered a carpenter's cabin near Schlieben. The carpenter was sitting on the edge of a bed on which a child was sleeping. A ball of fire sprang suddenly and with a loud noise from the fireplace to the bed, which was immediately shattered. Then the ball rolled very slowly to the opposite wall of the room, through which, or the floor, it apparently vanished with another fearful crash without setting fire to anything. The man's wife and another child were sleeping in a second bed and the baby in a cradle, all in the same room, but none of the five persons was wounded or even stunned. All complained of headache and deafness on account of the heavy sulphurous vapor which filled the room, but they soon recovered. Some fractures were discovered about the stove and chimney.

Less fortunate were the children in a schoolhouse in Bouin, France, who were visited by a fireball while at their afternoon prayers. It was preceded by a shower of lime, wood, and stones. The ball, which was small, rolled along under the benches, killing three of the children, and went out through a window pane, in which it merely made a round hole, whereas all the other panes were shattered.

On January 2, 1890, a ball appeared in an electro-technical establishment in Pontevedra, Spain. It was seen to strike the line wires about nine o'clock in the evening *under a clear sky*, but no one could say just how it struck or from what direction it came.

The ball, which was about as big as an orange, moved slowly along the wires to the central station and struck the dynamo, which was running. Before the eyes of the terrified workmen it sprang twice from the dynamo to the wires and back. Then it fell from the machine and burst into a shower of sparks without doing any damage. The electric lamps flickered during its visit, and the thick copper plates of the switch were melted and welded in places.

Of especial interest is the appearance of a large number of balls during a tornado on August 18, 1890, in the French *Departement Ille et Vilaine.* A farmer of Vizy, who was caught by the storm in the field, saw a fireball fall with great velocity. Panic-stricken, he threw himself on the ground. The luminous ball struck the earth, burst with a loud noise, and covered him with dust.

Dwellers in Vers l'Eau and Samiset saw balls as large as a man's head and of a vivid red, which moved slowly toward some barns, where they vanished after setting the haystacks on fire. In Saint-Claude a great number of balls entered dwellings by the chimneys. They moved slowly to and fro and escaped through windows, doors, and walls, after doing more or less damage. The air in the houses was impregnated with the smell of sulphur or gunpowder.

The region of the Hochgebirge is especially favorable for the observation of globe lightning.

Alluard, the director of the observatory on the Puy-de-Dôme, reports that frequently during thunderstorms showers of small balls of fire are seen falling. On the peak Saentis, in the same region, where a meteorological station was founded at an elevation of twenty-five hundred and four metres in 1882, some very remarkable phenomena were observed by a minister named Studer on June 28, 1885. He and a companion were caught out in the storm after nightfall. All at once they saw on the ridge extending from Saentis to the neighboring peak of Altmann flaring flames and small yellow balls of light. The latter ran along as if on a wire, approached each other, then exploded and fell down. A single larger ball of fire hovered over the same ridge, moving to and fro in a flat parabola with about the speed of a ball thrown by the hand, except that its velocity was uniform. It was visible for several minutes. Then there was a frightful explosion, which seemed to shake the whole mountain to its foundations, and a display of natural fireworks, "of a magnificence never before witnessed," amazed the spectators.

The telephone wire from the station to the valley glowed with great brilliancy as far as it could be seen, and waving sheets of fire extended from it to the ground. Suddenly the whole fiery

mass fell to the earth, the wire melted, and the spectators were left in total darkness.

The nature of this peculiar form of lightning is not yet understood, although Planté and F. von Lepel have succeeded in producing in the laboratory, with the aid of powerful electrical machines, small balls of fire which, like those of Nature, moved to and fro for a while and then vanished.

These experiments have suggested the theory that the fireballs consist of heated air and water vapor. But this theory is insufficient, and gives no satisfactory explanation of the various phenomena which have been observed. The subject still needs investigation. It is especially desirable to increase our store of working material—that is, of observations. Whoever, therefore, is fortunate enough to have witnessed a display of globe lightning should communicate his observations to one of the meteorological journals.—*Translated for the Popular Science Monthly from Die Gartenlaube, by Lawrence B. Fletcher.*

WORLD'S GEOLOGISTS AT ST. PETERSBURG.

By WILLIAM H. BALLOU.

THE Fifth International Geological Congress at Washington received an invitation from the Russian government to hold its seventh session in St. Petersburg. The Sixth Congress at Zürich accepted the invitation. By unanimous vote, A. Karpinsky, Director of the Committee of Geologists of Russia, was elected president of the Bureau of Organization; A. Inostranzew, vice-president; Th. Tschernyschew and N. Androussow, secretaries.

His Majesty the Czar will open the Seventh International Congress at St. Petersburg on August 17th, and welcome the visiting delegates to his empire. The Grand Duke Constantinovitch will act as Honorary President. Prof. Karpinsky will doubtless be made President of the congress. Circulars of information in French have been received by geologists, outlining the occupations of the delegates, so far as the Russians can arrange for their pleasure. The sessions will last seven days, preceded and succeeded by intervals of geological and sight-seeing excursions, covering the principal areas of Russia.

In many respects this will be the most important of the congresses so far held. The geological map of Europe, which will probably be printed complete in two years, will be exhibited. Segments of this map have already been received by geologists, and will probably have their hearty approval at the congress. The

committee on geological nomenclature will doubtless make a fair showing, although beset by many difficulties in harmonizing the views of members. A difference of opinion of grave proportions, which has threatened the life of past congresses, concerns the probable culmination of previous attempts of geologists to get the control of the organization out of the hands of officials of the scientific bureaus of various governments. The excursions laid out certainly cover a vast territory, including the Ural Mountains, Moscow, Volga River region, Samara to Kazan, the glacial formations of Esthonia, Finland, basin of the Donetz, mineral waters of Vladikavkaz, Nijni-Novgorod, Kiew, Dnieper River, to Tiflis and glaciers by military route of Georgia, Tiflis to Baku, Batoum, and Kertch, all parts of the Crimea, Sebastopol, southern Russian mining region, to the glacier Guenaldon at Piatigorsk, Lake Gokhtcha, Mount Ararat, etc.

THE GRAND DUKE CONSTANTINOVITCH, President of the Imperial Academy of Sciences and Honorary President of the Congress.

The International Geological Congress was conceived by the American Association for the Advancement of Science at the Buffalo meeting, 1876, when a resolution was adopted, calling for such a congress to be held in Paris in 1878. The committee comprised W. B. Rogers, Dr. James Hall, J. W. Dawson, the late Dr. J. S. Newberry, the late Dr. T. Sterry Hunt, C. H. Hitchcock, R. Pumpelly, of America; the late Prof. T. H. Huxley, Dr. Otto Torrell, and E. H. van Baumhaur, of Europe. Dr. Hall was made chairman of the committee and Dr. Hunt secretary. Their labors resulted in the first international congress being held in Paris in 1888. The second congress was held in Bologna, the third in Berlin, the fourth in London, the fifth in Washington, and the sixth in Zürich, at intervals of three years.

The geological map of Europe was conceived at the congress of Bologna, where it was determined that the methods of accomplishing the ends of unification in nomenclature and coloring had become sufficiently understood. It was thought best to select

PROF. A. KARPINSKY, Director of the Imperial Geological Survey and President of the Bureau of Organization of the Congress.

Europe as the subject of the map because it contained a great area, practically well known, the largest number of geologists, and included the greatest number of cartographical difficulties. Containing the largest number of geologists, representing many nationalities, it was conceded that any map which could pass their acceptance would stand any test of criticism elsewhere. The inherent puzzles of structure in Europe furnished a fascinating series of difficult problems for solution, long and zealously discussed, with both natural and artificial intricacies. No better area to test the patience and tax the genius of the congress could have been chosen. The committee appointed to prepare the map comprised Messrs. Beyrich and Hauchecorne, of Germany, with power of direction at Berlin; Prof. Renevier, of Switzerland, as general secretary; Messrs. Daubrée, of France; Giordano, of Italy; A. Karpinsky, of Russia; Mojsisovics, of Austria-Hungary; and Topley, of Great Britain. Professors Daubrée, Giordano, and Topley have since died. The scale of the map is one in one million and a half. It is divided into forty-nine sheets of 18·89 by 20·86 inches. These sheets, when all are completed, will form a rectangle 11·04 feet high by 12·17 feet wide. The topographic base was prepared by Prof. Kiepert, of Berlin. D. Reimer & Co., Berlin, are the pub-

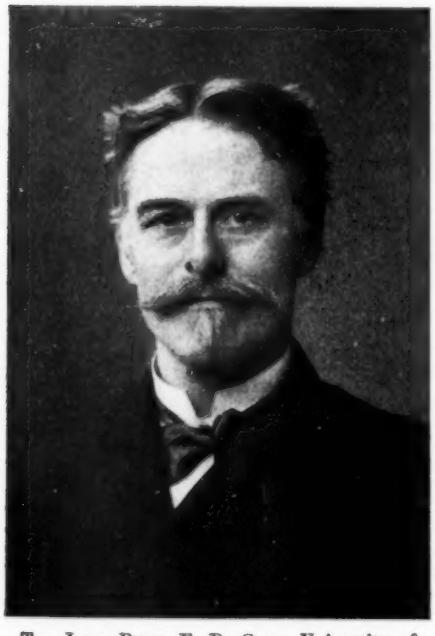
DR. JAMES HALL, New York State Geologist.

lishers at their own risk. The price of the work was fixed at 125 francs ($25). The various national committees subscribed and paid the publishers for nine hundred copies at the rate of 100 francs each. The map represents the completest and most accurate geological information obtainable, and every step in its progress has been carefully taken, so that the result forms a consensus of European opinion.

Prof. Persifor Frazer, Philadelphia Academy of Sciences.

At the last congress at Zürich, Switzerland, two propositions were submitted by Dr. Persifor Frazer, and the bureau was ordered to report on them at St. Petersburg, as follows:

"1. To what extent does the congress recognize the right of governmental bureaus as such, or of any kind of organizations, to send representatives to the congress?



The Late Prof. E. D. Cope, University of Pennsylvania.

"2. Within what limitations does the congress recognize the right of such representatives, or of only a portion of the members of the congress coming from the same country, to choose who shall be the vice-president representing their country, or to take any other steps in the name of their country without consultation of all of their countrymen, members of the congress?"

In these propositions is said to lie the future of international geological congresses. If government officials are alone to represent

PROF. C. D. WALCOTT, Director, United States Geological Survey.

were declared by the Swiss council alone eligible and representative, and were made vice-president and delegate from the United States. At present too many members of government bureaus comprise the official roster of the congress, although the congress itself is composed of several hundred of the most distinguished geologists of the world, who, if not members of a geological survey, are ignored by those now in control. This is a situation which does not commend itself to scientific men, many of whom occupy chairs in great universities or eminent positions as specialists. These men think the abuse has become a flagrant one. countries and hold office, the congress at St. Petersburg may be the last. Formerly the officers of geological surveys of nations fought the establishment of the congress. The congresses once established, the bureaucrats changed front, got hold of the machinery through their representatives, and now mostly control it. At St. Petersburg the unofficial geologists of the world will try to wrest the direction from the members of geological surveys. At Zürich, for instance, there were present thirteen of the most distinguished geologists of the United States. Two salaried assistants of the United States Geological Survey

PROF. J. J. STEVENSON, University of New York, President New York Academy of Sciences.

If there is an object for the congress to accomplish, it is to open its doors and honors equally to all geologists. It is thought that if the congress decides that only bureau employees enjoy exclusive privileges and alone constitute the *personnel* of the permanent organization, which keeps the organization alive in session and out, then the body has simply become a medium of officialism, a governments' trust, and should be disbanded. As a trust, it will simply continue to extenuate errors and preserve the power of government survey directors. The independent geologists think the congress has been perverted and diverted from its original high purpose, and that the time has come to rescue it. They desire it to be the highest tribunal of appeal on purely scientific matters.

PROF. C. H. HITCHCOCK, Dartmouth College.

PROF. B. K. EMERSON, Amherst College.

The protesting Americans are led by Dr. Persifor Frazer, of Philadelphia, who is an able linguist and parliamentarian. He will represent the American Philosophical Society, the Philadelphia Academy of Sciences, and the editorial staff of the American Geologist. Prof. Giovanni Capellini (Italy), who recently received the Hayden medal and who will probably be decorated by the Czar at this congress, thinks the battle against officialism already won. In a recent letter he states: "The committee of organization has the good

PROF. WILLIAM N. RICE, Wesleyan University.

tervening work of these committees has been adopted, clause by clause. Whenever unsettled questions were announced they were either adjourned to subsequent sessions, or discretion was granted to the committees to mature their own plans. The committees have been remarkably successful, and no attempt has been made by them to force their conclusions on the congresses or introduce into the discussions the narrow partisanship of particular schools. Among the men who have been active in the unification of coloration are Profs. Zittel and Hauchecorne, of Germany; Prof. Thomas McKenny Hughes, of England; Prof. Del-

intention of returning the congress to the right path, in conformity with the object of its institution, having recognized that it has been entirely deflected from its path in Switzerland." While the committee's "intentions" may be good, it will require something more powerful to break down officialism and restore the chair of a university to its equality with a membership of a government bureau.

Two international committees have been at work for some years to secure a uniform nomenclature and coloration in European geological science. At each session of the congress the in-

PROF. N. H. WINCHELL, University of Minnesota, State Geologist.

walque, of Belgium; Prof. de Lapparent, of France; Prof. J. Szabó, of Hungary; Profs. Delgado, Choffat, Bensaude, Goncalves, and de Lima, of Portugal; Prof. Stefanescu, of Roumania; Prof. Mayer-Eymar, of Switzerland; Profs. Capellini and de Zigno, of Italy; Prof. Nikitin, of Russia; Prof. Stur, of Austria; Prof. Vilanova, of Spain; Prof. Johnstrup, of Denmark; Prof. Kjerulf, of Norway; Prof. van Calker, of Holland; and Prof. Torrell, of Sweden.

The committee on the unification of the nomenclature of rocks comprises Knop, Zirkel, and Rosenbusch, of Germany; Golliez, Hutenmal, and Schmidt, of Switzerland; Renard and de la Vallée Poussin, of Belgium; Behrens and Wichmann, of Holland; Macpherson and Gonzalo y Farin, of Spain; Bensaude, of Portugal; Michel-Levy, Barrois, and La Croix, of France; Teall, Geikie, and Judd, of England; Brögger, of Norway; Zujovis, of Roumania; Löwinson-Lessing, of Russia; Tietze and Tschermak, of Austria-Hungary; J. P. Iddings, Whitman Cross, and C. R. Van Hise, of the United States; and Barcena, of Mexico.

PROF. EUGENE A. SMITH, University of Alabama, State Geologist.

A committee will report on an exhaustive study of the changes which occur in glaciers, for which Prince Roland Bonaparte is chairman and pays the cost. It is composed as follows: Richter, of Austria; Fintswalder, of Germany; Reid, of the United States; Bonaparte, of France; Hall, of England; and Forel, of Switzerland.

The original American committee of the International Congresses has been somewhat decimated by death. It comprised Prof. James Hall, chairman, Albany; Dr. Persifor Frazer, secretary, Philadelphia; the late Dr. J. S. Newberry, New York; the late Dr. T. Sterry Hunt, Montreal; Prof. C. H. Hitchcock, Hanover, N. H.; Prof. Raphael Pumpelly, Newport; Prof. H. S. Williams, Yale; Prof. J. P. Lesley, Philadelphia; Major J. W. Powell, Washington; the late Prof. G. H. Cook, Brunswick, N. J.;

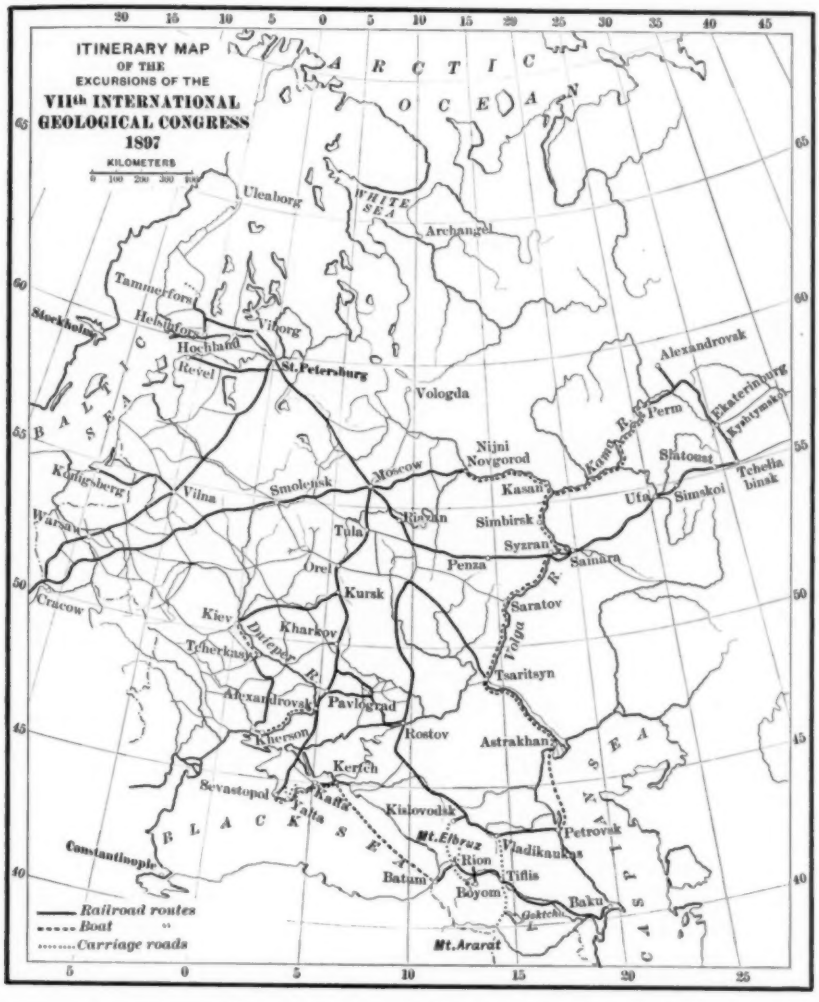
Prof. J. J. Stevenson, New York; the late Prof. E. D. Cope, Philadelphia; Prof. Eugene A. Smith, Tuscaloosa, Ala.; Prof. N. H. Winchell, Minneapolis; and the late Prof. James D. Dana, New Haven. Most of those above living will be present at St. Petersburg, and are nearly all opposed to the control of the congress by bureaucrats. Through the efforts of the former *personnel* of the United States Geological Survey, the American committee was abolished at the Indianapolis meeting of the American Association for the Advancement of Science, where the survey staff got temporary control. At the last meeting of the Association, at Buffalo, the following delegates were appointed to St. Petersburg: Prof. James Hall, Albany; the late Prof. E. D. Cope, Philadelphia; Prof. B. K. Emerson, Amherst; Prof. C. D. Walcott, Washington; and Prof. W. N. Rice, Middletown. These delegates will soon be made a new American committee, and their number materially increased in the near future. The delegates of the Geological Society of America will comprise Prof. J. J. Stevenson, New York University; Prof. B. K. Emerson, Amherst College; and Prof. I. C. White, Morgantown, W. Va.

PROF. H. S. WILLIAMS, Yale College.

All objects for exhibition bearing the address "Russia, St. Petersburg Exposition of the International Geological Congress," can go through without having to be submitted to customs inspection at the frontier. Russian consuls everywhere have been instructed to *visé* passports of geologists presenting membership cards, which will also facilitate matters at the frontier. Members will receive a ticket of first-class transportation on all Russian and Finland railways. The sessions of the congress will be held at the Imperial Academy of Sciences.

Accompanying this article is a copy of the official map of the excursions offered to geologists by the Russian Government, which has made great sacrifices to entertain its guests. Over six hundred membership cards have been issued, in consequence of

which the committee has decided to exclude from the excursions all who are not authors of geological publications. It is estimated that the restriction will reduce the number of excursionists to about two hundred people. The cost of the excursions, reduced to the mere maintenance of individuals, has been fixed



approximately as follows: To the Urals, four hundred francs; in Esthonia, one hundred and thirty-five francs; to Finland, fifty francs; the great excursion after the congress, six hundred and sixty-five francs; to Ararat, two hundred and seventy francs; to the glacier Mamisson, one hundred and twenty francs; to Elborous or Sebastopol, forty francs additional to general excursion. Each of the smaller and special excursions have a price established, estimated at twenty-one francs per day. The committee

will refund any overcharges made. These magnanimous reductions in the cost of travel are due to the personal efforts of A. Yermolow, Minister of Agriculture, to the proprietors and administrations of the districts having works, and to the officers of municipalities along the routes of the excursions.

WOMAN SUFFRAGE AND EDUCATION.*

By HELEN KENDRICK JOHNSON.

IN 1848 a Woman-Suffrage Convention, called by Mrs. Stanton, Mrs. Mott, and others, issued a "Declaration of Sentiments," which was an imitation of the famous Declaration of Independence. It constituted an elaborate indictment of man as the oppressor of woman, and the suffrage leaders of to-day still hold to it as their broad exposition of principles. The seventh count in the indictment was, "He has denied her facilities for obtaining a thorough education, all colleges being closed against her."

Among the resolutions passed in an early suffrage convention was one demanding "equal rights in the universities," and the first petition presented by suffrage advocates contained a clause asking that entrance to men's colleges be obtained for women by legal enactment. We note that this is far from being a demand for education for women equal to that given to men in the universities. Men have founded colleges for women, men and women have worked together in securing for woman every facility and opportunity for education of the highest grade; but the "barrier of sex" is not broken down in education. But few of the older colleges for men admit women, and those few, so far as I have learned from conversation with members of their faculties, speak of the arrangement as an experiment, and give the need for economy, combined with a desire to assist women, as a reason for making that experiment. Meantime the knocking at men's literary portals by suffrage advocates has gone on as vigorously as if women could obtain education in no other way.

In the first suffrage convention ever held in Massachusetts these two resolutions were adopted: "That political rights acknowledge no sex, and therefore the word 'male' should be stricken from every State Constitution"; and "that every effort to educate woman, until you accord to her her rights, and arouse her conscience by the weight of her responsibilities, is futile, and a waste of labor."

* From Woman and the Republic. By Helen Kendrick Johnson. In press of D. Appleton & Co.

The State in which these sentiments were uttered abounded in fine schools for girls, among which were Mount Holyoke and Wheaton Seminaries.

A rapid survey of some of the educational conditions that led to the state of things existing when suffrage associations were formed will be in place. Learning seemed incompatible with worship early in the Christian era. The faith that worked by love was "to the Jews a stumbling-block and to the Greeks foolishness." That great battle between the felt and the comprehended, which in this era we have named the conflict between science and religion, was decided in the mind of the apostle to the Gentiles when he wrote: "We know in part, and we prophesy in part; when that which is perfect is come, that which is in part shall be done away." He recalled the accusation, "Thou art beside thyself, much learning hath made thee mad," and he hastened to assure the unlettered fishermen and the simple and devout women who were followers of Christ, that "all knowledge" was naught if they had not love; that even faith was vain if it led to the rejection of the diviner wisdom that a little child could understand.

The great learning of Augustine and the Fathers brought into the Church pagan speculations of God and morality, as well as pagan knowledge in art, science, and literature. The Church became corrupted, and a great outcry was made against the learning itself, which was falsely supposed to be the cause of the degeneration of faith. Symonds says that during the dark ages that followed upon this first battle between faith and sight, the meaning of Latin words derived from the Greek was lost; that Homer and Virgil were believed to be contemporaries, and "Orestes Tragedia" was supposed to be the name of an author. Milman says that "at the Council of Florence in 1438, the Pope of Rome and the Patriarch of Constantinople being ignorant, the one of Greek and the other of Latin, discoursed through an interpreter." It was near the time of the Reformation that a German monk announced in his convent that "a new language, called Greek, had been invented, and a book had been written in it called the New Testament." "Beware of it," he added, "it is full of daggers and poison."

But the tradition of the love that book revealed had crept into the heart of the world, and now awoke. Through what struggles the "spirit of all truth" promised by Christ was leading, and would lead the world, the history of civilization can tell. Women shared in some degree the outward benefits of the revival of learning. They became in not a few instances doctors of law and professors of the great universities that sprang up, as well as teachers, transcribers, and illuminators in the great nunneries.

I could give a long and honorable list of names of woman writers and artists, in many lands, from mediæval to modern times; and one of the interesting things revealed by such a record would be the number who were working with or were directly inspired and helped by a father or a brother. The court had some names of women who, like Lady Jane Grey, upheld the model of purity while taking the learning that naturally accompanied wealth. But elegant letters had again become the associate of moral and religious corruption in the courts, and the "ignorance of preaching" arose to combat it in Cromwell, the Roundheads, the Dissenters, the Covenanters.

Yet sound learning was not to die that Christian truth might live. Of the band of Pilgrims and Puritans that came first to our shores, about one in thirty was college bred. While subordinating book knowledge to piety, they had learned scarcely less the dangers of ignorance. Their first college was founded because of "the dread of having an illiterate ministry to the churches when our ministers shall lie in dust." Charles Francis Adams says, in regard to the establishment of Harvard College, "The records of Harvard University show that, of all the presiding officers during the century and a half of colonial days, but two were laymen, and not ministers of the prevailing denomination." He further says that "of all who in early times availed themselves of such advantages as this institution could offer, nearly half the number did so for the sake of devoting themselves to the gospel. The prevailing notion of the purpose of education was attended with one remarkable consequence—the cultivation of the female mind was regarded with utter indifference."

It was attended with still another remarkable consequence, the effect of which is felt up to this hour. Only men who were fitted for a profession were given a college education. It is well within my memory when it began to be seriously said: "A college education is good for a boy, whether he intends to follow a profession or not; it will make him a better business man, or even a better farmer." The country girl is now, as a rule, better educated than her brother. It also happened in those earlier days that the artist and the musician were expected to attain knowledge by intuition, save in technical branches.

During the first two hundred years of our existence it would have been almost absurd to expect that women would be extensively educated outside the home. The country was poor, and struggling with new conditions, and great financial crises swept over it. There were wars and rumors of wars. Until after 1812–'15 American independence was not an assured fact. Whatever may be said of the present, woman's place in America then was in the home, and nobly did she fill that place. That she had not

been wholly uninstructed in even elegant learning is evidenced by the share she took in literature and in the discussion of religious and public matters, and in such personal records as that of Elder Faunce, who eulogized Alice Southworth Bradford for "her exertions in promoting the literary improvement and the deportment of the rising generation." Dame schools were early established for girls, and here were often found the sons of the farmer and the mechanic. These were established in Massachusetts in 1635. Late in 1700 girls were admitted through the summer to "Latin schools" where boys were taught in winter, and in 1789 women began to be associated with men as teachers. In 1771 Connecticut founded a system of free schools in which boys and girls were taught. In 1794 the Moravians founded a school for girls at Bethlehem, Pennsylvania. Here were educated the sisters of Peter Cooper, the mother of President Arthur, and many women who became exponents of culture.

New England began before this to have fine private schools for girls, but no great step was taken until Miss Hart (afterward Mrs. Willard) had become so successful with her academy teaching in her native town of Berlin, Connecticut, and in Hartford, that three States simultaneously invited her to establish schools within their borders. She went to Massachusetts, but afterward, at the solicitation of Governor Clinton, of New York, she removed her school to Troy in 1821. It was a new departure, and there was ignorant prejudice to overcome. Governor Clinton, in an appeal to the Legislature for aid, said, "I trust you will not be deterred by commonplace ridicule from extending your munificence to this meritorious institution." They were not deterred. An act was passed for the incorporation of the proposed institute, and another which gave to female academies a share of the literary fund. The citizens of Troy contributed liberally, and the success of an effort for woman's high education was assured.

As early as 1697 the Penn Charter School was founded, and it has lived until to-day. Provision was made "at the cost of the people called Quakers" for "all children and servants, male and female, the rich to be instructed at reasonable rates, the poor to be maintained and schooled for nothing." They also provided for "instruction for both sexes in reading, writing, work, languages, arts, and sciences." The boys and girls have been taught separately, the girls' school being much behind the boys, neither Latin nor other ancient language forming a part of their curriculum. Friends are just beginning to discuss giving higher education to girls. This is a fact especially significant in our discussion, because it has always been claimed that the Quaker doctrine that "souls have no sex" led them to place woman on an "equality" with man before other sects had thought of allowing that

they were equals. Lucretia Mott, Susan Anthony, Abby Kelley, and a great body of the women who adopted the resolution that set forth the uselessness of educating woman until she could vote, and who clamored for her entrance to men's institutions, were all of this sect that has kept its women generally far behind in the acquisition of knowledge.

In 1845 Mrs. Willard was invited to address the Teachers' Convention that met in Syracuse. She prepared a paper in which she set forth the idea that "women, now sufficiently educated, should be employed and furnished by the men as committees, charged with the minute cares and supervision of the public schools," but declined the honor tendered her of delivering it in person. Sixty gentlemen from the convention visited her at the hotel, and at their earnest request she read the essay, which met with their emphatic approval of the plan she proposed. The employment of women in the common schools and the system of normal schools were projected by her.

A teachers' convention was held in Rochester in 1852. Miss Anthony, though a teacher, was not in attendance upon it, but she records that she went in and listened for a few hours to a discussion of the causes that led to their profession being held in less esteem than those of the doctor, lawyer, and minister. In her judgment the kernel of the matter was not alluded to, so she arose and said, "Mr. President." She writes that "at length President Davies stepped to the front and said in a tremulous, mocking tone, "What will the lady have?" "I wish, sir," she said, "to speak to the question." "What is the pleasure of the convention?" asked Mr. Davies. A gentleman moved that she be heard; another seconded the motion; whereupon, she says, "a discussion, *pro* and *con*, followed, lasting full half an hour, when a vote was taken of the men only, and permission was granted by a small majority." She adds that it was lucky for her that the thousand women crowding that hall could not vote on the question, for they would have given a solid "No." The president then announced, "The lady can speak." "It seems to me, gentlemen," said she, "that none of you quite comprehend the cause of the disrespect of which you complain. Do you not see that, so long as society says a woman is incompetent to be a lawyer, minister, or doctor, but has ample ability to be a teacher, every man of you who chooses this profession tacitly acknowledges that he has no more brains than a woman? Would you exalt your profession, exalt those who labor with you. Would you make it more lucrative, increase the salaries of the women engaged in the noble work of educating our future Presidents, Senators, and Congressmen."

Several thoughts arise in regard to this scene, which was so

strongly in contrast with the conduct of Mrs. Willard or any of the great educators. Miss Anthony gave no reason for her belief that the entrance of woman upon the other professions would raise either the status or the wages of those engaged in the teacher's profession, and as a matter of fact it has not done so. It was not the society that cast scorn at woman's "lack of brains" which assisted to remove the natural prejudice against her assuming duties that had been deemed unsuited to her physique and her necessary work.

Meantime, one year before the Rochester meeting was held, the first college for women had been chartered at Auburn, N. Y., under the name of "Auburn Female University." In 1853 it was transferred to Elmira, and it was formally opened in 1855. It was placed under the care of the Congregational Church, but its charter required that it should have representative trustees from five other denominations. Its course of study for the degree A. B. was essentially the same that was then pursued in the men's colleges of the State. It was expected to rely upon endowment, which put woman's education upon a new and more secure footing.

Suffrage leaders lose no opportunity to represent the Church as an enemy to woman's advancement. Nothing can be further from the truth; and in striking evidence stand the colleges, which, while unsectarian in spirit and in method, have been established and cared for by special religious denominations. Dr. Jacobi, in her book Common Sense, takes up the tale and says, "The Mount Holyoke Seminary, the immediate successor of that at Troy, was opened in 1837 by Miss Lyon, in spite of the opposition of the clergy." Many besides the clergy were opposed to the plan for which Miss Lyon was endeavoring to raise money. Her idea that the entire domestic work of the establishment could be done by pupils and teachers was thought unwise and hopeless; and it was simply this feature that they disapproved, not the school itself. In that noble school, where thousands of women have been educated, a great number have become missionaries. When a suffrage convention in session in Worcester wrote to Miss Lyon, asking her to interest herself in the wrongs of her sex, she answered, "I can not leave my work." Neither was Vassar College founded from any impulse or suggestion of suffrage agitators, but in a spirit exactly the opposite. The real impetus to its founding came from Milo Parker Jewett. He suggested to Mr. Vassar an endowed college for women, and visited the universities and libraries of Europe with a plan of organization in mind. Mr. Vassar gladly accepted this great enlargement upon an idea that had lain dormant in his own mind, and Vassar College was founded, Dr. Jewett becoming its first president in 1862.

I may claim to have been beside the cradle of Vassar College; for when Dr. Jewett resigned the presidency in 1864, my father named the successor, who was appointed, Dr. John H. Raymond, his lifelong friend. Dr. Raymond came to Rochester to discuss a plan of work, and, knowing my father's interest, I was on tiptoe to hear about the new college. At my earnest solicitation he and Dr. Raymond and President Anderson permitted me to be present at their discussions. I learned to comprehend the value of womanliness to the world by the estimate that those noble educators put upon it. It was evident that they were arranging for those for whose minds they felt respect. They made no foolish remarks about the superiority, inferiority, or equality of the sexes, and had no contempt to throw upon the old education of tutor and library and young ladies' seminary. They did not sneer at the "female mind," but they did talk of the feminine mind as of something as distinct in its essence from the masculine mind as the feminine form is distinct in its outlines. To "preserve womanliness" was a task they felt they must fulfill, or the women for whose good they labored would one day call them to account. The dictum so frequently in the mouths of suffrage leaders, "There is no sex in brain," would have been abhorrent to them. In their view, there was as much sex in brain as in hand; and the education that did not, through cultivation, emphasize that fact, would be a lower and not a higher product. They laid that intellectual corner stone in love, and in the faith that the same womanly spirit which, when there was not college education enough to go round, had said, "Give it to the boys, because their work must be public," would find, through the glad return the boys were making, a way to teach the world still higher lessons of womanly character and influence. Since that time college after college has arisen without a dream on the part of the founders, faculties, or students that "every effort to educate woman, until you accord to her the right to vote, is futile and a waste of labor," and it may well be that the women educated in these colleges will decide that, because political rights do acknowledge sex, therefore the word "male" should not be stricken from any State Constitution.

Before the committee of the New York State Constitutional Convention in 1894, Mr. Edward Lauterbach, who was arguing in favor of woman suffrage, said: "It was only after the establishment of the Willard School at Troy, only after its noble founder, believing that women and men were formed in the same mold, successfully tried the experiment of educating women in the higher branches, that steps for higher education became generally taken." If Mr. Lauterbach imagines that Mrs. Willard was in the most distant way an advocate of woman's doing the same work as man in the same way, he is unfamiliar with her life and work. Mrs.

Willard, in setting forth her ideal of woman's education, said: "Education should be adapted to female character and duties. To do this would raise the character of man. . . . Why may not housewifery be reduced to a system as well as the other arts? If women were properly fitted for instruction, they would be likely to teach children better than the other sex; they could afford to do it cheaper; and men might be at liberty to add to the wealth of the nation by any of the thousand occupations from which women are necessarily debarred." Old-fashioned wisdom, but choicely good.

In a woman's club, last winter, a New York teacher, Miss Helen Dawes Brown, a graduate of Vassar College, founder of the Woman's University Club and also one of the founders of Barnard College, in a speech said in part: "The young girl who doesn't dance, who doesn't play games, who can't skate and can't row, is a girl to be pitied. She is losing a large part of what Chesterfield calls the 'joy and titivation of youth.' If our young girl has learned to be good, teach her not to disregard the externals of goodness. Let our girls, in college and out, learn to be agreeable. A girl's education should, first of all, be directed to fitting her for the things of home. We talk of woman as if the only domestic relations were those of wife and mother. Let us not forget that she is also a granddaughter, a daughter, a sister, an aunt. I should like to see her made her best in all these characters, before she undertakes public duties. The best organization in the world is the home. Whatever in the education of girls draws them away from that, is an injury to civilization."

At the close of an article in The Outlook, written by Elizabeth Fisher Read, of Smith College, she said, speaking of their last adaptation of athletics: "From the beginning, the policy of Smith College has been, not to duplicate the means of development offered in men's colleges, but to provide courses and methods of study that should do for women what the men's courses did for them. Emphasis has been put, not on the resemblances between men and women, but rather on the differences. The effort has not been to turn out new women, capable of doing anything man can do, from walking thirty miles to solving the problems of higher mathematics. Instead of this, the college has tried to develop its students along natural womanly lines, not along the lines that would naturally be followed in training men."

This sounds strangely like Mrs. Willard, who would be the first to rejoice in the new education and in the old spirit that it can develop. Of course, suffrage claims to have the same end in view. Every college woman must decide for herself where she will stand on the question. So far, there never has been any open affiliation between the colleges and the suffrage movement.

The kind of education best suited to the idea of suffrage is a training in political history and present political issues; but the women who have talked loudly and vaguely of the right of suffrage for years have been the last to present such knowledge. I have read their History, attended their conventions, glanced at their magazines, but never have come upon the discussion of a single public issue. I think those most familiar with it will bear me out if I make the statement that their principal periodical, The Woman's Journal, edited by Mary A. Livermore, Julia Ward Howe, Mr. Blackwell, and Alice Stone Blackwell, has not contained any presentations of questions of public policy in the past ten years.

One of the grievances of the suffrage leaders lay in the fact that the literary women of the country would express no sympathy with their efforts. Poets and authors in general were denounced. Gail Hamilton, who had the good of woman in her heart, who was better informed on public affairs than perhaps any other woman in the United States, and whose trenchant pen cut deep and spared not, always reprobated the cause. Mrs. Stowe stood aloof, and so did Catherine Beecher, though urged to the contrary course by Henry Ward Beecher and Isabella Beecher Hooker. In a letter to Mrs. Cutler, Catherine Beecher said: "I am not opposed to women's speaking in public to any who are willing to hear, nor am I opposed to women's preaching, sanctioned as it is by a prophetic apostle—as one of the millennial results. Nor am I opposed to a woman's earning her own independence in any lawful calling, and wish many more were open to her which are now closed. Nor am I opposed to the organization and agitation of women, as women, to set forth the wrongs suffered by great multitudes of our sex, which are multiform and most humiliating. Nor am I opposed to women's undertaking to govern boys and men—they always have, and they always will. Nor am I opposed to the claim that women have equal rights with men. I rather claim that they have the sacred superior rights that God and good men accord to the weak and defenseless, by which they have the easiest work, the most safe and comfortable places, and the largest share of all the most agreeable and desirable enjoyments of this life. My main objection to the woman-suffrage organization is this, that a wrong mode is employed to gain a right object. The right object sought is, to remedy the wrongs and relieve the sufferings of great multitudes of our sex; the wrong mode is that which aims to enforce by law instead of by love. It is one which assumes that man is the author and abettor of all these wrongs, and that he must be restrained and regulated by constitutions and laws, as the chief and most trustworthy methods. I hold that the fault is as much,

or more, with women than with men, inasmuch as we have all the power we need to remedy the wrongs complained of, and yet we do not use it for that end. It is my deep conviction that all reasonable and conscientious men of our age, and especially of our country, are not only willing but anxious to provide for the good of our sex. They will gladly bestow all that is just, reasonable, and kind, whenever we unite in asking in the proper spirit and manner. In the half a century since I began to work for the education and relief of my sex, I have succeeded so largely by first convincing intelligent and benevolent women that what I aimed at was right and desirable, and then securing their influence with their fathers, brothers, and husbands, and always with success."

Miss Beecher, like Mrs. Willard and Mrs. Phelps, made textbooks for the use of her own seminaries, and her Arithmetic, and Mental and Moral Philosophy, and Applied Theology were among the educational forces of her day. It is one of the significant signs of the times that science and education, as well as philanthropy, are occupying themselves just now with childhood and motherhood and housewifery. Mrs. Willard's high ideal of womanliness is beginning to be set forth by the electric light of modern thought.

THE HISTORY OF ALCOHOL.

By Dr. CHARLES ERNEST PELLEW.

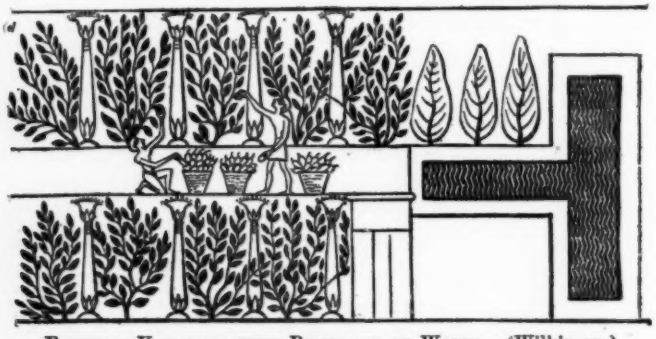
I.

IN studying the history of alcoholic beverages we are at once brought face to face with the fact that there has hardly been a nation on the face of the globe which has not used some variety of stimulant or narcotic. In almost every instance this has been some form of alcohol, and in a few cases where alcohol has been unknown, and tobacco, opium, hemp, or some other drug used in its stead, the introduction of alcohol has been followed at once by its use and, alas! its abuse. A curious example of this is given in the account of Henry Hudson's famous voyage in 1609, when he discovered the Hudson River. The Indian chief and warriors waited for him on the shore of Manhattan Island, prepared to sacrifice to the great "manito in red." He landed, with a few of his crew, and pouring out some rum into a glass, drank it to their health, and then passed a cupful round to the Indians. One after another they shrank from it, evidently fearing that it contained a deadly poison. At last one, bolder than the rest, drank it down, and soon began to reel and stagger, and finally fell. His companions were horror-struck. But soon he recovered

himself, and described his drink in such glowing terms that they all begged and implored for their share, and, before Hudson left, they had all become intoxicated.

In other words, there seems to be a natural craving by man for some drug which shall "drive dull care away," and, as alcohol possesses this power, it has been used from the earliest ages and is still being used by rich and poor, high and low, civilized and savages, in more or less complete disregard of the evil effects of overindulgence.

The earliest historical records which have come down to us—the sacred classics of China, India, Judea, and Persia—all give details about the use and abuse of alcoholic beverages. The Chinese



EGYPTIAN VINEYARD, WITH RESERVOIR OF WATER. (Wilkinson.)

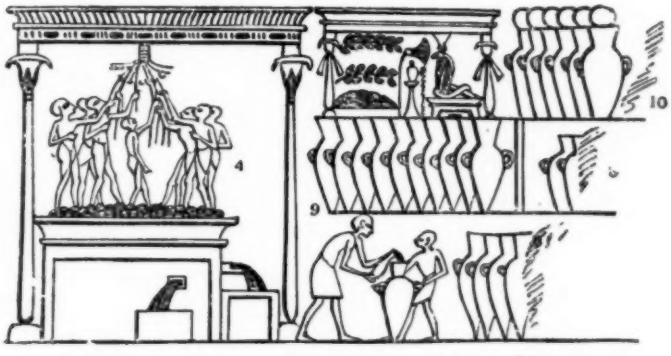
made use both of wine from grapes and of a beer made from rice, somewhat like the present *saki* of Japan; and, if we can believe their writings, intemperance was not at all confined to the lower classes, but in many instances proved the disgrace and the ruin of the reigning dynasties.

The Rig-Veda, or sacred books of the ancient Brahmans, give us many details about the Hindu drinking customs, which were, among the upper classes at least, closely connected with their religious observances. The common people drank a variety of beer, known as *sura*, made from rice, barley, honey, and other ingredients. This was cheap and freely used for intoxicating purposes, and was, accordingly, in great disrepute among the priesthood and rulers, who made most stringent rules and regulations against it. But they were full of the praises of the sacred wine, *soma*, made from the juice of certain plants, which, after fermentation, was offered as a libation to their favorite gods, Indra, Vishnu, and others. These deities were supposed to drink *soma* freely, and to be highly gratified at the resulting intoxication. These exercises were particularly pleasant because it was not necessary, in order to honor the gods, to pour out all the wine upon the altar, but the act of devotion might be equally well per-

formed by the worshipers drinking the libations themselves. Of course, the pleasant after effects were considered as solely due to the divine favor, and not to any ingredient common also to the vulgar *sura*.

WINE PRESS OF MATTING. (Wilkinson.)

In the Bible we find frequent references to both the good and the evil effects of wine. In such marked contrast do some of these passages stand that serious effort has been made, by many well-intentioned moralists, to attribute all the favorable comments—"Wine that maketh glad the heart of man," "Thou hast put gladness into their hearts since the time that their corn and wine and oil increased," and the like—to unfermented grape juice or to the fruit itself, and to apply to the fermented juice, the wine of our everyday life, only the passages, so well known and so frequently quoted, of condemnation. Some grounds for their belief exist in the fact that two Hebrew words, *yayin* and *tirosh*, occurring in the Old Testament, are both translated in the authorized version as "wine," although *yayin* is almost always mentioned with scorn and contempt and *tirosh* with approval. But this is not always the case. The substances meant by both words are condemned alike in a chapter in Hosea (Hosea, iv, 2). And, furthermore, it is very doubtful whether the unfermented grape juice is not mentioned under an entirely different word, *debish*, translated as honey. In that hot climate, with no glass jars and rubber stoppers in which the sterilized grape juice could be preserved, and with no antiseptics to delay or prevent fermentation, the fresh grape juice must have been at once boiled

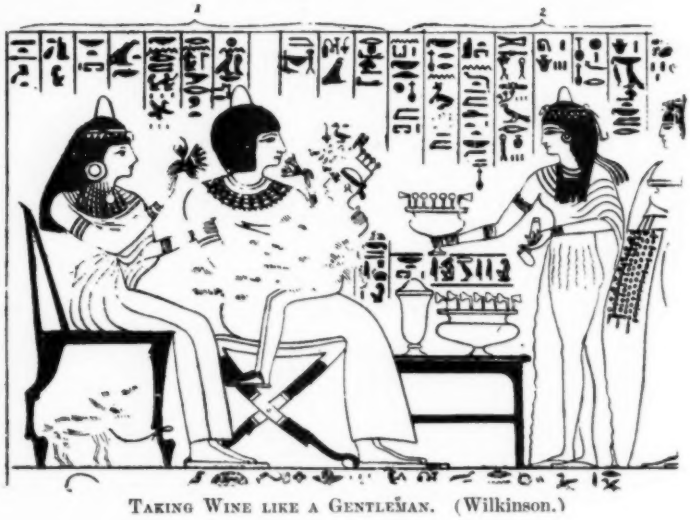


PRESSING THE GRAPES AND STORING THE WINE. (Wilkinson.)

down to a thick sirup, or it would have begun to ferment in half an hour. That is the present practice in Syria, and the resulting *debs* is used to this day as a substitute for honey or sugar for sweetening purposes. And our respect for the wisdom of King David and other great men of Judea hardly permits us to think that their enthusiastic language was used about a sweet, cloying sirup.

There is no reason at all to doubt that the Greek word οἶνος, used in the New Testament, refers to the ordinary fermented wine; and, on the whole, it seems evident that in both Old and New Testament the commendations and denunciations refer to the use and abuse of alcohol, respectively, rather than to any specific differences between the beverages employed.

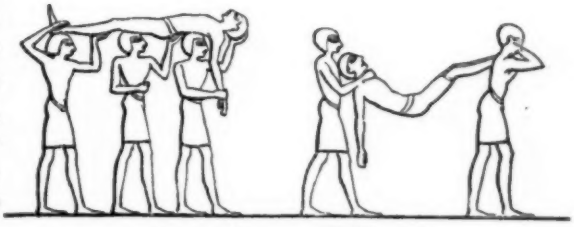
The ancient Egyptians at a very early date discovered the art of making barley wine, or, in other words, true beer, as well as



TAKING WINE LIKE A GENTLEMAN. (Wilkinson.)

grape wine. They have left evidences of this, not only in their writings and in the tales of early travelers like Herodotus, but also in several remarkable series of mural paintings found on their monuments. The most interesting of these are at the tombs of Beni-Hassan, where, some five thousand years ago, the Egyptian artists amused themselves by portraying the scenes of every-day life in a most graphic manner. We find there pictures of vineyards, with the vines carefully trained on trellises, and watered from artificial reservoirs. We find several varieties of wine presses—some for treading the grapes, some for pressing the grapes by twisting them tight in a bag. We can see how they poured the fresh wine into jars for fermentation and storage. We can watch them drinking their wine like gentlefolk, in the

bosom of their family, with wife by the side and children on the knee. And, finally, we find pictures of them using wine like beasts—men being carried home from supper on the backs of slaves; women staggering round, hopelessly and indecently intoxicated. Verily "there is nothing new under the sun."



After a Supper. (Wilkinson.)

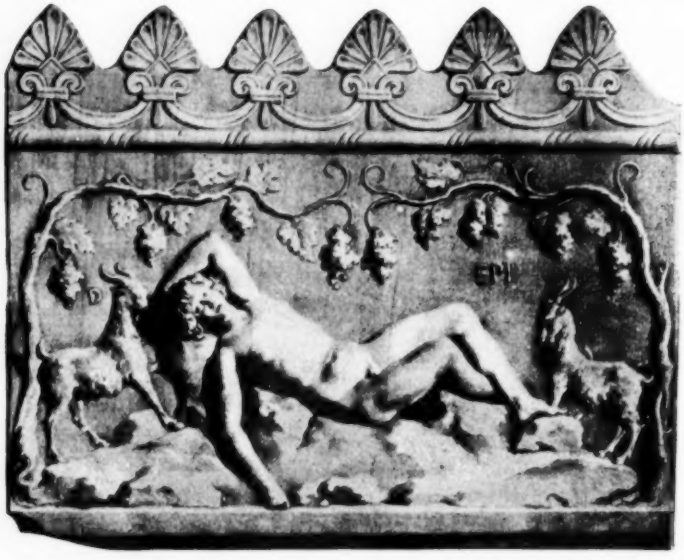
The ancient Persian writings, the Zend Avesta, dating back to the period of Zoroaster, possibly 4000 to 6000 B. C., contain like the Rig-Veda many references to a sacred drink, *homa*, and a popular drink, *hura*. Wine seems to have been of somewhat later discovery, but, once introduced, proved extremely popular. The lowlanders, living in the rich, warm plains of Asia Minor, were especially addicted to its use, and the temperate young prince Cyrus, coming down from the mountains with his Persian warriors, found little difficulty in routing the effeminate Medes. But the attractions of luxury proved too strong for them, and, in a few generations, both rulers and people had badly degenerated. The famous Xerxes, the Great King, the descendant of Cyrus and monarch of Asia Minor, left as his epitaph no great record of valiant deeds, but the sole fact that "he was able to drink more wine than any man in his dominions." Small wonder, then, that his forces were so easily routed by the Greeks.

For, of all races that have yet appeared, the Greeks have been best able to use alcoholic beverages freely and yet with temperance. Their land was fertile and their crops varied, and they early learned how to prepare intoxicating drinks from barley, figs, the palm, and other sources. And their wines, especially those from the Greek islands, have retained their reputation, not for hundreds but for thousands of years. The vine was widely cultivated, and valued as one of the greatest gifts of the gods to man; and yet, such was their respect for the human body and such their dread of injuring it by excesses, that we

A Woman Intoxicated. (Wilkinson.)

find that, in their golden age at least, alcohol was used and not abused.

Their strongest drink, we must remember, was natural, unfortified wine, containing no more alcohol than our present clarets



SLEEPING DIONYSOS. (From Greek bas-relief in the Campana Collection.)

and hocks. And yet they never drank it pure; they always added water to it, or rather, added it to water. Some of their wines, the Pramnian and Maronian, for instance, were of such strong flavor as to be mixed in the proportion of one to fifteen or one to twenty parts of water. The average dilution was one to five, or one to four. When the young bloods of Athens had a supper party they would elect a "master of the feast," who sat, crowned with flowers, at the head of the table, and set the pace for the festivities. A very festive youth would sometimes at these occasions order the wine one to three, or even two to three. To drink wine unmixed—well, that was ἐπισκύθισαι, to act like a Scythian, to be a beast and a barbarian.

It is not to be supposed from this that drunkenness was unknown, but in the golden age of Greece it was both uncommon and despised. Drinking with them was different from drinking among other nations; they drank for exhilaration, not for intoxication. This can be recognized at once from the character and position of Dionysos, their god of drink, corresponding to the Roman Bacchus. No drunken debauchee was he. His statues represent him as a laughing, innocent child, as a beautiful, graceful youth, as a finely developed adult, and even as a gentle, refined, full-bearded man, the patron of literature and the drama.

For Dionysos was one of the greatest gods of Greece. At the vintage in the autumn all was fun and jollity, and in his honor rude, humorous plays were acted by the country people. Hence developed the "comedy," so named from κῶμος, the country cart from which the actors at first held forth. In the spring, at the opening of the new wine, occurred the great Dionysiac festival. Every one flocked to Athens, from the countryside, from all Greece, from the whole civilized world; and there, in the great Theater of Dionysos, the marble seats of which are still standing under the walls of the Acropolis, were acted the glorious tragedies of Æschylus, Sophocles, and Euripides, the noblest masterpieces of ancient literature.

But after Athens and Sparta, and later Thebes, had wasted their resources and exhausted their energies against each other, a new and fierce and semibarbarous race came down from the mountains and conquered the whole of Greece. Under the famous King Philip of Macedon the weak and scattered clans united, learned the art of war, and rapidly overthrew the more civilized and cultivated lowlanders. This marked the end of Grecian temperance. The Macedonian nobles were always heavy drinkers, and toward the end of his career they were encouraged in their habits by the king himself.

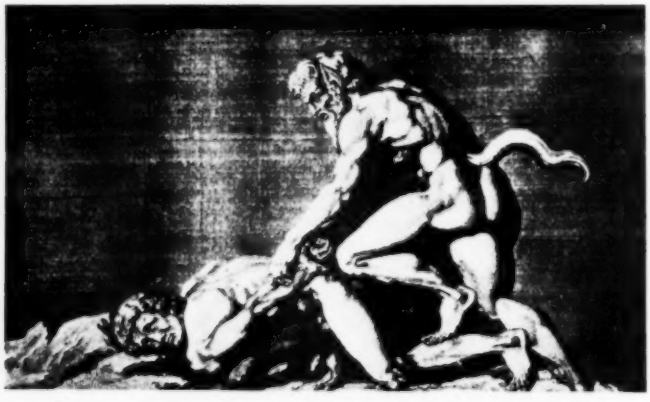
Many stories have been handed down to us about the royal drinking bouts. One, which has passed almost into a byword,

DIONYSOS, FROM THE CHORAGIC MONUMENT OF LYSICRATES.
(From The Antiquities of Athens, Stuart and Revett, 1762.)

relates to a famous philosopher, who brought a lawsuit, in which he was a party, up before the highest court, the king himself. The case was heard and the judgment given against him. "I appeal," shouted the old man. "Whom do you appeal to?" said Philip, "I am the king!" "I appeal," said the other, "from Philip drunk to Philip sober." And the next day

the case was heard over again, and decided in the appellant's favor.

Another episode, which bade fair to have very serious results, happened the year before he died. He had recently divorced his



SATYR PUNISHING A SAILOR, FROM THE CHORAGIC MONUMENT.

wife Olympias, the mother of Alexander the Great, and was celebrating his marriage to a new wife, Cleopatra. At the wedding banquet, where the wine flowed very freely, her uncle Attalus made some insulting remarks about the young prince Alexander, who at once rose in his place at the table and threw a goblet at his head. This enraged the king, who sprang from his seat, drew his sword, and rushed at his son to kill him. But, in his rage and intoxication, Philip slipped and fell to the ground. Then Alexander, rather unfilially, shouted out: "See now, men of Macedon, this man, who is preparing to cross from Europe to Asia, can not step from one couch to another without falling!"

When Alexander came to the throne, a year later, the improvement in manners was but temporary. At first, indeed, the young king, with his companions in arms, devoted all their energies to affairs of state and war. Two years after he came to the throne he crossed the Hellespont, and with a small but picked army routed the vast, unwieldy hosts of the Great King. In a few campaigns he conquered Asia Minor, and even led his victorious forces into India. But with success came intemperance, and his brief and glorious career closed in disgrace.

In the garb of Dionysos, accompanied by a band of drunken roisterers, he entered Carmania in triumph. At Samarcand, inflamed by wine, he killed with his own hand his friend Clitus, who had saved his life at the battle of the Granicus. At Persepolis, in a drunken frenzy, urged by dissolute companions, he set fire to the famous palace of the Great Kings, and although,

sobered by the result, he urged his soldiers to the rescue, it burned to the ground.

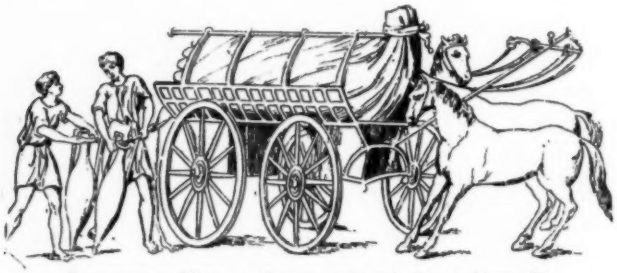
His most famous exploit in this line took place, during the last year of his life, at the tomb of Cyrus, near Pasargadæ in Persia. He attended here the immolation of a famous Hindu philosopher, Calanus, who had followed him from India, and now, falling sick, burned himself alive on a great funeral pile. On his return from the ceremony Alexander asked many of his friends and chief officers to supper, and that night organized a great drinking contest, offering a gold crown to the victor. A young nobleman called Promachus took the first prize, with the respectable measure of some fourteen quarts of wine, and others followed close behind him. But a cold wind came up that night, chilling the revelers to the bone, and Promachus and some forty

MÆNADS IN A DIONYSIAC FRENZY. A great figure of this sort, with splashes of blood on the garments, was one of the chief ornaments in the Dionysiac Theater. (From the Campana Collection.)

of his competitors died from the effects of cold and drunkenness combined.

This course of life could not last long. His soldiers murmured, his officers grew unruly, his own strength failed; and, in his thirty-second year, after a drinking bout that lasted for two days and nights, a sudden attack of fever ended his career.

Turning from Greece to Rome, we find the same general course of events. At first the Romans were a band of fierce banditti, fighting first for life, then for conquest, against the surrounding tribes. During the few hundred years that this struggle continued the Romans were a temperate, a painfully temperate race. We read that wine was scarce and poor, and, such as it was, reserved exclusively for the men, and for men over thirty. Women were forbidden to use it under pain of death, for the alleged reason that it was an incentive to licentiousness. According to Pliny, this last law was by no means a dead letter. Women were obliged to greet all their male relatives with a kiss on the mouth, so that it could be told if they had been at the wine cellar. He quotes the case of one Ignatius Mecenius, who cudgeled his wife to death for this offense, about B. C. 700, and was



DELIVERING WINE. (From a wall painting at Pompeii.)

pardoned by Romulus for the deed; and he tells of another case, four hundred years later, where a Roman dame was starved to death by her relatives for similar reasons.

Later on, when they had conquered most of Italy, wine became more common, and when the Roman arms reached Greece and Asia Minor the country was flooded with it. We learn from contemporary writers that manners and customs changed within one generation. Old Cato used to tell how, at his father's table, only common Italian wine was served, and that sparingly, while the Greek wine was handed round as a great luxury in small glasses at dessert. And before his death one general, Lucullus, returning from the East, distributed one hundred thousand gallons of fine Chian wine to the populace.

The later Romans cared more for their wine than for any other natural or artificial product of land or sea. Pliny mentions that there were one hundred and ninety-five varieties in general use, of which about eighty were of fine quality. Common wine was extraordinarily cheap and abundant, so much so that it was a jest of the poets that it was less expensive than water. Fine sweet dessert wines were imported in large quantities from the Grecian isles, Chios, Samos, Lesbos, Mitylene, and the rest. And

the famous Italian vintages, the strong, fiery Falernian, the rich Massic, the sweet Alban, the Cæcuban, Setine, Pucine, and others, sung by Horace and Virgil and Lucretius, held the palm over all their rivals, and in many respects must have compared favorably with those of the present day.

But most of them would have been spoiled for our tastes by the curious substances which were added to them, for flavoring or as preservatives. For instance, both in Greece and Rome it was a quite common practice to mix honey, and also various spices, myrrh and aloes and cloves. A more surprising admixture was that of salt water, which, in small quantities, one to fifty or so, was believed to greatly improve the flavor of fine wines. Indeed, most careful directions are given by the old writers about the quality of this salt water. It must be drawn from the ocean, some three miles from shore, on a calm day, when the sea was at rest. Another, and to us barbarous, habit was that of adding resin or pitch or turpentine, either directly to the wine, or by smearing the wine vessels before filling them. This is done in Greece up to the present day, and the modern traveler is asked in the taverns whether he wishes "foreign wine" or "resined wine"—οἶνος ἐξότικος or οἶνος ρεσινήτης.

In one respect they were fully our equals. They appreciated the value of age. We still, some of us, have our wine cellars, and "lay down" our wines for aging. We smack our lips over a glass of Château La Rose of '70, and think it old; while "Stuyvesant" or "Monticello" Madeira, from the beginning of the century, is doled out, on rare festal occasions, a few drops at a time, like a precious elixir.

But in Cæsar's day we hear of Hortensius, a well-known orator, leaving his heir ten thousand casks of good Greek wine in the cellar of his country house. Plump little Horace, always referring to his poverty, can still write to a friend and ask him to visit him at his humble cottage, and take a glass of Falernian laid down "Consule Planco," some thirty years ago. His patron Mæcenas used to give him wine—*Marsi memorem duelli*—that remembered the Marsian war, seventy or eighty years before. And we learn from Pliny that, in his day, there was still in existence some of a famous "cru" of wine, made in the consulship of Opimius, some two hundred years before. This wine, we read, was only used for flavoring other varieties. It was thick, so that it had to be dug out with a spoon, and dissolved in water, and strained before using it, and when the cover was taken off the jar it emitted a delightful, powerful fragrance which filled the whole room.

From the fall of the republic on, intemperance and licentiousness increased in Rome with rapid strides. Nothing more was

heard of the old laws; the women drank just as heavily as the men. All the writers—Pliny, Juvenal, Seneca, Tacitus, Athenæus, and many more—are full of bitter complaints against the prevailing habits. No order, no decency, was observed at their feasts. They rapidly became regular drinking bouts, where not only host and guests, but even the freedmen and slaves, drank themselves to unconsciousness.

Prizes were commonly offered, at these, to the heaviest drinkers, and it was customary to use drugs to increase the normal capacity for liquor. A separate chamber adjoining the dining room bore the suggestive name of *vomitorium*. The emperors themselves did not disdain to encourage these orgies. Under Claudius a certain Caius Piso was promoted at court for drinking consecutively for two days and nights. One man, Torquatus, was actually knighted under the name of Tricongius, or "Three-gallon Man," for taking that quantum of wine, so it was said, at a single draught. The populace, the home army, and the court were all equally intemperate; and it is no wonder that, when once the outer defenses of the empire were broken through, the rest collapsed and fell to pieces before the onslaughts of the hardier, even if no less intemperate, Northern races.

THE PUBLIC AND ITS PUBLIC LIBRARY.

By JOHN COTTON DANA.

THE opponents of the system of free, tax-supported public schools never have been answered. That they are wrong in their position is not proved, as so many seem to think, by a simple reference to the great growth and seeming success of the free public-school system and its attendant free public library system in this country. An institution may thrive, may apparently fulfill the purpose for which it was designed, and may at the same time be working great harm to the people who have adopted it and maintain it and trust in it—a harm which may become apparent only after a long series of years, and apparent at first, even then, only to the most careful observer. It is a familiar fact that a great change in governmental policy may not produce its full effect for many decades. We are still in the dark as to what will be the final outcome, and especially the final effect on character, of the free public educational system.

The individualist opponent of that system says that the individual is the important thing. He contends that the individual is happiest when he has the maximum of freedom; that he best develops when he most fully reaps the rewards of his own exer-

tions and his own self-denials, and most fully receives the punishment of his own indolence and his own prodigality—of his own failure to adjust himself to men and things about him. The mass, he says, may restrain the individual who would make an attack on others; it may refuse to affiliate with the individual who does not do those things which it thinks he should do. For the mass to do more than this, he says, is so to restrict individual activity and to prevent the play of natural forces as to make impossible the development of the only kind of individuals that can form the ideal society.

This is stating it crudely. It at least suggests, however, that the advocate of liberty has on his side some of the arguments gained from the study of biology and of history. The former seems to tell us that the fittest have survived in open fight—that only by this open fight do those more fit appear; the latter seems to tell us that the better government governs the least; that the only wise thing the ruler, whether king or majority, can do for the social organism is to let it alone.

If it is of doubtful expediency, then, for the sovereign majority to take from the individual by force the means wherewith to maintain a library for the pleasure and edification of all, it is the part of wisdom to see that that library is made, as far as may be, the sure antidote to the possible bane of its origin. It must teach freedom, by its contents and by its administration. It must cultivate the individual. It must add to the joy of life. Always it must truly educate.

It is in the light of the preceding, perhaps rather doctrinaire, remarks that the following notes have been written and should be read.

The public owns its public library. This fact sheds much light on the question of public library management. It means that the public library must be fitted to public needs. It must suit its community. It must do the maximum of work at the minimum of expense. It must be an economical educational machine. It must give pleasure, for only where pleasure is is any profit taken. It must change in its manner of administration with the new time, the new relations of books to men and of men to books. It need not altogether forget the bookworm or the belated historian, and it can take note here and there of the lover of the dodos and the freaks among printed things. But its prime purpose is to place the right books in the proper hands, to get more joyful and wise thoughts into the minds of its owners. The means of its support are taken by force from the pockets of the competent and provident; this fact should never be lost sight of. It lives in a measure by the sword. It can justify itself in this manner of securing its support only by putting into practice the

familiar theory that the state, would it insure its own continuance, must see that all its citizens have access to the stores, in books, of knowledge and wisdom. It must be open to its public; it must invite its public; it must attract its public; it must please its public—all to the end that it may educate its public.

The old-time library was simply a storehouse of treasures. There were few to read books; there were few books to be read, and those few were procured at great cost of labor and time. They could be replaced when lost or stolen only with great difficulty, if at all, and they were guarded with exceeding care. With the cheapening of book-producing processes the reasons for this extreme safe-guarding of books disappeared. Its spirit, however, is still active. Several causes have combined to keep it alive. Even to this day there are a few books, relatively very few, which are of great value and can be replaced only with extreme difficulty or at great expense. There are also books—first editions, fine bindings, last surviving copies, and early specimens of printing—which are rightly much prized by the artist, the antiquarian, the curio hunter, or the historian of handicraft. These are all most properly regarded as treasures, and are kept under lock and key. But the fact that there are a few books which should be carefully preserved from loss or injury is not sufficient cause for keeping up in these days a barrier between the public and its library. Set aside these greatly valued books and the few works highly prized for certain special reasons which the average library contains, and there is left the great body of modern books, not expensive, easily replaced, and of far more importance to ninety-nine in a hundred of any public library's constituents than all the book curios the world contains. In any save the very richest and largest libraries in this country the books which can not be duplicated at a reasonable cost have no proper place. It is with the modern, inexpensive works that the public library chiefly concerns itself. Its art publications and its rarities of every kind can easily be disposed of in safety vaults or private rooms. Its more valuable works of reference can be guarded from any probable mutilation by a little special service. Its main collection, sixty to eighty per cent of the average library, is what the public wishes to use. These form any library's real tools in its avowed purpose of aiding in the education of the community in which it is placed.

The readers of books, moreover, are no longer few but many, and have greatly changed their manner of looking at books and the guardianship of them in the past hundred years. The tax-paying citizen to-day has his own daily or weekly paper, if nothing more, and knows well that a printed page is no longer a sacred or an expensive thing. He walks up to the shelves of the bookstore

or to the counter of the news stand and selects his own reading, under his own rules, in accordance with his own opinion of his needs, and after an actual inspection of what the shelves can afford him. He has learned, or is fast learning, that public library treasures are in the main treasures no longer; that the only rational selection of reading is one made after the examination of many books; and he is beginning to demand that he be permitted to come in immediate contact with the volumes he is invited to read. The public library, whether it be a library which the people are taxed to maintain or a library which belongs to them by gift, must, so the demand goes, be managed with as much consideration for its patrons and with as much appearance of faith in their honesty as the ready-made-clothing house or the bookstore. This demand is seconded by the new view of the functions of a public library; it is, in fact, a part of this new view. The library is no longer looked upon as a storehouse of learning, to be used by the few already learned; it is thought of as a factor in the growth of the community in wisdom, in social efficiency, and a factor therein second only to the public schools, if second even to them. It is accordingly widening its business of book distributing by the addition of the powers possible to it as a laboratory of general learning. Of books it is as true as of the materials of chemistry, botany, or biology—and even the non-literary, wayfaring man begins to see this—that only by working among them and with them can one get out of them their real worth. The public to-day, in a word, sees the importance—the absolute necessity, in fact—of the laboratory method in that study of books which underlies, or at least accompanies, the study of all other things.

In its attractiveness to the would-be student, not to mention the desultory reader, the library whose resources are open for examination and selection is far superior to the one which keeps its patrons on the outside of the delivery counter. The book buyer finds delight in a personal inspection of the volumes he would select from. It is by the unrestrained browsing through a score of inviting volumes that the student, whether beginner or expert, finds at last the one which meets his case. To all who are drawn, whether in ignorant questioning or in enlightened zeal, to visit a collection of books, the touch of the books themselves, the joy of their immediate presence, is an inspiring thing. Those who have had experience of both methods testify that the open library gives more pleasure, encourages reading of a higher grade, and attracts more readers than the library which is closed to the public.

The cheapness of books; the growth of the public's feeling of ownership in its library, and of the propriety of laying hands on

its own; a recognition of the great educational value of the laboratory method in library administration; and the widening of its field of work which a library gains by the added attractions of free access to its shelves—these considerations, save in certain peculiar cases, seem to decide the question of the proper policy of the public library toward its public. That more communities do not now demand the adoption of the system of open shelves in their public libraries is due largely to the conservatism of library boards, and to an unreasoning submission to authority on the part of the reading public. Even the enlightened are slow to ask for a right before they have exercised it and experienced its advantages.

These statements of proper library methods will seem to the reader who is not familiar with public library methods as they are, simple, commonplace, and self-evident. He may well wonder why one takes the trouble to repeat them in print. By way of justification it should be said that the manner of conducting a public library now in almost universal use in this country is this: Between the books and the would-be users of them is placed an insurmountable barrier. At this barrier stand librarian and attendants. The reader or student flounders about in a list of the library's books until he arrives at a guess—it is often not more than a guess—at the titles of the books he wishes. A list of these books he hands over the barrier to the attendant, and of them the attendant brings him the first one that happens to be in. Perhaps he wishes to make a study of some subject. Generally, in such a case, he must make out a list from a brief catalogue of the books which he thinks may help him, and of the titles of articles which he surmises will be useful in files of periodicals or proceedings. This list, handed to the attendant, brings him some of the things called for. Half of them are probably not what he expected, and he must try again. Always between him and the sources of information the personality of librarian or attendant obtrudes itself. His wants must trickle over a library counter, and then must filter through the mind of a custodian who is perhaps not very intelligent and is probably not very sympathetic, before they can be satisfied by contact with the books themselves. In a good many libraries a few reference books are placed where any one can reach them. But this is in most cases the limit of the concession made to the demand for immediate contact with the library's resources. The new library in Boston has stored the most of its popular books, the books which the majority of its patrons most call for, in a dark warehouse, lighted only by artificial light, and reached, as far as the borrower is concerned, only by mechanical contrivances which compel a wait of nearly ten minutes for every book called for. The borrower can not see the books; he can not

even see the person who does see them. He must depend on lists, telephones, pneumatic tubes, and traveling baskets—and this in the most expensive and most extensive and most lauded library in the United States to-day.

What, now, the open-shelf method of administration being decided upon, should be the character of the building in which the public library is housed? The storehouse idea must be discarded at once. What is wanted is a workshop, a place for readers and students, not a safety-deposit building. The men and women who visit the library and use it—their convenience and comfort must be first consulted; how the books are to be stored is another and a secondary question. Nor can the monumental idea be for a moment maintained. The library, if it is to be a modern, effective, working institution, can not forego the demands of its daily tenants for light, room, and air, and submit to the limitations set by calls for architectural effects, for imposing halls, charming vistas, and opportunities for decoration. The workshop, the factory, the office building, the modern business structure of almost any kind, these, rather than the palace, the temple, the cathedral, the memorial hall, or the mortuary pile, however grand, supply the examples in general accordance with which the modern book laboratory should be constructed. It is a place, is this book laboratory, in which each day hundreds and thousands of visitors must, for ten minutes or as many hours, use their eyes in reading type of all degrees of excellence and badness. First, then, every sacrifice must be made to secure all possible daylight in every corner. It is a place, again, in which many of the daily visitors will wish to go, at the same time, to the same shelves, the same cases, the same alcoves, or the same rooms, and the same desks and tables. Space—well-lighted, well-ventilated floor space—then, should be given to the public with the utmost prodigality. There is no room left, unless economy in construction and administration be entirely disregarded for architectural display, except as it is the natural outcome of plans based primarily on utility.

The power of a library lies first in its books. Up to a certain variable limit, varying with their character and with the time and the place, quantity of books is of first importance. As the library supported by compulsory taxation is justified only as it serves to make the ignorant citizen wise and the wise citizen wiser still, its first care should be for its supply of tools—its implements for cultivating wisdom—its books. The library building, as of the second and not of the first importance, should therefore be economical in its construction. It need not be, it should not be, penurious in its appearance. To a limited extent it may speak to the passer-by of the generosity of the community, of the respect in which its builders hold the business of education. But if solid

and plain and manifestly adapted to the purpose for which it is designed, it can not well escape the attributes of dignity, and, to the reasoning observer, of beauty. The magnificent pile, to which architect and trustee can point the casual passer-by with pride, which may awe the taxpayer into forgetfulness of the contractor's bills, this has no excuse. It comes, and it promises to come often; but it is permitted by the populace in momentary forgetfulness of the public library's excuse and function, not in reasoned belief in the utility of bibliothecal palaces.

The free public library building, large or small—and of the college, university, or reference library the same may be said—so constructed as to serve thoroughly well the purposes for which it is intended, exists in theory only. It may be possible to find in this country a few small libraries in which an honest attempt has been made, with moderate success, to grapple with the library building problem. In the vast majority of cases such light as experience in library administration is able to throw on the question of the proper internal arrangement of a library building—the proper distribution of expenditure in securing room, light, ventilation, and workableness—has been simply ignored. Arguments drawn from utility, from comfort of readers and borrowers, and from economy of administration, have been set aside. Full rein often, the loose rein always, has been given to trustees' and architects' desires for architectural effect. This is the more strange because certain principles of library construction are well understood and are no longer matters for debate.

Convenient, economical, effective administration of a library calls for greater ease of access and facility of communication in the building used than does any other form of business, be it industrial, commercial, official, administrative, or religious. And this need for ease and speed in intercommunication increases rather than diminishes with the increase in the size of the library, and in the number of its patrons. Illustrations of how this general principle of library construction has been ignored may be easily found. To note the Newberry Library in Chicago and the Boston Public Library is here sufficient. Compare the accommodation possible for the busy and impatient patron—and the busy and impatient patron is one of the patrons the modern library should especially strive to serve—in these ill-adapted structures with that possible, with a few quite minor changes, in the modern tall office building, and the point is made clear at once. The whole monumental style of library architecture is almost of necessity the greatest of handicaps on library administration. It may be said, of course, that it is sometimes advisable to erect first a noble monument, then to make out of it as good a library as its monumental character permits. Granted. But it should be thoroughly understood,

when such a building is up for consideration, that it is a monument, not a library. When our architects have fully seized the modern situation in its demands and its materials; when the spirit which put up the lying exteriors of the Chicago World's Fair buildings, and thereby delayed our architectural emancipation by many a long day, has begun to die out, it may be possible to erect a thoroughly useful and entirely workable building which shall be in every part a library and also an artistic monument.

The point in the free public library to which the public comes in the largest numbers is the delivery counter. The public side of this delivery counter should be a room easy of access from the street, with cloak and toilet rooms near its entrance; well lighted, that catalogues and lists may be easily consulted, and that the work of the assistants may be done in the main without artificial light; large enough to accommodate comfortably the greatest crowd the library expects ever to attract; and so closed in that the talk and movement which necessarily accompany intercourse between visitors and the library staff will not disturb workers or readers in other parts of the library. A corner of this room, easy of access from the counter, should be devoted to the information desk, at which the stranger or the student will get prompt and courteous and full replies to all questions in regard to the library's methods and resources, and suggestions in regard to books or departments to be consulted on any specific topic. Near this information desk should be the desk at which borrowers' or members' cards, permits, etc., are issued. In the delivery room, or in a room opening from it, should be the catalogue resources of the library. The delivery counter should be so constructed as to serve as an aid in the transaction of business—as a means of communication, not as a barrier—between the assistants and the public. Near to it and easy of access should be the books of the lending department; nearest to it, those most used. If for good reason it is found necessary to forbid the public access to any part of the lending department, it may prove advisable to place such part at some distance from the delivery counter, and to move the books to and fro by means of lifts, belts, or like devices. But any plan by which the attendant, to whom a request for certain books is made, is prevented from easy access to them, stands in the way of the library's educational work, especially where the would-be borrower is himself denied the opportunity to see for himself, in any department, the books he would select from. If a book asked for is not in, another of equal or greater value on the same subject may be in. The borrower, denied access to the shelves, should at least have, if he wishes it, the benefit of the attendant's knowledge of this fact. A delivery service made up largely of mechan-

ical contrivances may easily put into the hands of the public several thousand books in a day. It may serve a good purpose in so doing. It may find its proper field in performing part of the book-lending work in any large library. But it certainly can not compete, from an educational point of view, with a service in which the attendant puts himself for the moment in the inquirer's place, and himself goes to the shelves with an intelligent interest in the inquirer's wants.

Near the counter should be the catalogue room; and the private official catalogue of the library should be open to the public, if possible. Such an arrangement saves much costly duplication. It is also desirable to have the information about the library's books which is stored up in the catalogue room made available for the public at short notice.

Near the delivery room and not far from the main book room should be a special room for children, in which may be kept all juvenile literature, so arranged that the children may make their own choice from the shelves. This will prove a strong attraction to the young people, will increase their use of books of the better class, will free other parts of the library from the disturbance children necessarily entail, and will save time and labor at the delivery counter.

The room for reference work, if the whole library is not thrown open for this purpose, must be not far from the main book room, must be near the catalogue, and should be near the delivery counter. It should be so planned that those who come to the library simply for a book, or to ask a question, or on sight-seeing, will not be compelled to pass through it.

The retiring rooms and lunch rooms for assistants, the conversation or class rooms for special work, the rooms for rough work —as mending or binding and the manual part of the preparation of books for the shelf—the periodical room, and the newspaper room can all be placed at a distance from the library's real center, the delivery counter; though the last two must be near enough to the reference room to make it easy for readers in the latter to consult the current numbers of magazines and journals.

The office of the librarian in charge should be near to the delivery room, and preferably not far from either catalogue or reference room.

The books in the public library should be selected with reference to the people who will use them. The people who make use of the free public library are, sixty per cent or more of them, readers of little but the newspapers, the popular magazine, and novels. The reading room should supply, and generously, the newspaper and the periodical. The circulating department should put much thought and much energy into fiction. The fiction

shelves, perhaps above all others, should be open to the public. If they are thus open, the question of how low in the scale of literature the library must descend in its selection of novels to attract as many readers as its income will permit it to supply will almost solve itself. Liberty to go to a collection of novels, embracing the best works of the best writers of all countries and all ages, will be attraction enough. It will not be necessary to put on the shelves books of the Southworth, the Roe, and the Mary J. Holmes school to draw to the library the ignorant and inexperienced. Such readers are wedded to their literary idols, not because they find them best, but because they know no others. They will not often take the evidence of expert or of catalogue that there are other good novels than those of which they have heard from fellow-readers in their own walk in life. But the book itself of the unknown writer, placed in easy reach, with attractive title, cover, and illustrations, will prove irresistible. Liberty to see, touch, peep into, and taste the new and heretofore untried will set the known and the unknown on the same plane in the mind of the inexperienced; and the unknown, if the better book and if selected with an eye to the library's constituency, will gain the day. The horizon of the inexperienced reader will, in such a library, soon widen. The devotee of mush and slush will, under her own guidance, following her own sweet will, almost unconsciously rise to a higher plane. She will be proud to think that she has found possibilities of pleasure in good authors whom she herself has had the wit to discover. The fiction list then will be long, but it will be select. Four to five thousand titles, many times duplicated, will cover the field.

With the shelves open, with full liberty of choice given, the obliging attendant will be all the more appreciated. He will obtrude no opinions and no advice, but will be ready and able to give both, if asked, or if opportunity offers. He will be supplemented with catalogues. And just as the library will make its fiction department—the department in which it will first reach, by which perhaps it can alone reach, from sixty to eighty per cent of its visitors—the most attractive and most carefully administered of all, so will it for this department best equip itself with aids and guides. It will have here catalogues of the most varied kinds—special lists, descriptive lists, like those of Griswold; historical lists, like that of the Boston Public Library; annotated lists, like that of the San Francisco Public Library; critical journals; and books and essays on the novel, its development and uses. In addition to all these things, it will tell the inquirer in which novels he can find set forth great historical characters and the prominent personages of fiction; in which he will find descriptions of notable scenes and historical events; in which are

found rare psychological analyses, striking descriptions that have become part of the everyday life of the cultivated; and discussions of social, political, and religious questions; and which novels will best tell him of life in this city, in that country, on the sea. In a word, the public's free public library will recognize at last the public's demand for the novel; will not attempt to excuse it, to hide it, to make light of it, or to counteract it; but will make use of it as an educational force in itself, and as a point of departure to more serious things. The novel reader is not a hopeless case. If he be a confirmed novel reader and nothing more, he has at least the reading habit, and in his youth can in most cases be led from that habit to question and to think.

The reference room of the free public library is in some sort already here. Not a few libraries recognize the reasonableness of a demand on the public's part for access to dictionaries, encyclopædias, atlases, gazetteers, and the like. Under the modern view the whole library becomes, of course, a great reference room. But the reference department proper, even in the modern public library, should contain ample accommodations in the way of desks, tables, writing materials, etc., for the casual inquirer or the student.

In other departments the wants of the reader, the beginner in learning, should be first supplied, books for the specialist being added as rapidly and to as great an extent as actual demand makes advisable and funds in hand make possible. No money should be expended on mere literary curios or on historical knickknacks. The historical society and the antiquarian can look after these things, and should not have the public purse for their competitor.

In accordance with the general spirit of the open-shelf method of administration, great liberality should be shown in the issuing of library cards. To the library itself for purposes of reference every one who applies will, of course, be admitted, so he be clean and reputable in appearance. To become an accredited borrower of books from the library one should be asked to do no more than sign some simple form of agreement. This, in addition to the information which can be obtained from a few questions put by librarian or assistants, with perhaps a reference to the city directory, has proved to be enough in actual practice to prevent the issuing of cards to people who wish them simply to make way with the library's books. In spite of this fact, the custom still holds in most libraries of demanding not only the signature of the person who wishes to become a borrower to an elaborate contract—this signature to be written at the library itself—but also the signature of some accredited citizen who agrees to become responsible for the borrower himself. This is entirely

unnecessary. The additional clerical work involved in the keeping of the two sets of names of borrowers and guarantors of borrowers, together with the labor necessitated by looking them up in directories and elsewhere, will cost more, save in very exceptional cases, than will the books which may be lost through the adoption of extreme liberality in the issuing of borrowers' cards. The people's money in this part of its library's administration, as in every other, should be spent rather in extending and making more easily accessible to the average citizen the library's resources than in setting barriers of red tape between the books and the people who own them and wish to use them.

SCIENCE AS AN INSTRUMENT OF EDUCATION.

By M. P. E. M. BERTHELOT.

THE part performed by science in the general education of the human mind and the progress of civilization has been often misconceived by pedagogues, hedged in as they are by the traditional formulas of classical teaching. I recollect having heard a conversation some twenty-five years ago between Duruy, then Minister of Public Instruction, and a general school inspector, in which Duruy spoke of the importance of the experimental sciences and the necessity of giving them a larger place in the school course. The inspector, proof against general ideas, and despising utilitarian results, the importance of which he could not comprehend, saw nothing in this but a kitchen school, good at most to teach future dealers in petroleum and coal. It would not be hard to find similar opinions among some of the blind partisans of classical instruction founded on the study of Greek and Latin.

Yet, if the material conditions of human life have been changed—if the accumulation of capital and the increase of the productive force of man's labor have gradually added to the general ease and given workmen a relative independence and rights which they did not formerly possess, and which are extending every day for the good of the race—such advance, we should never cease to recollect, is not due to literary studies or scholastic or religious or philosophical discussions, but is attributable essentially to the growth of science and to the increase of general wealth brought about by it.

This immense development of wealth and industry, as well as the correlative development of the liberal and democratic spirit, are due, we declare loudly, to the discoveries of modern science. If the supply of food at the disposal of the human species goes on

continually increasing, it is not by the effect of logical reasoning or theological declamation, but by the necessary results of discoveries in chemistry, mechanics, and physiology, which have already transformed agriculture and will transform it still further in a near future. However slowly peasants may change their traditional practices, we have taught them how to get from a field in a given time, with the same amount of labor and expenditure, a much larger quantity of wheat than the field formerly produced, and we are, in this matter, still very far from the goal that science permits us to set before ourselves. It is in consequence of the progress of science that everybody, or nearly everybody, in France now eats the white bread which formerly only richer people could get. The number of cattle we raise in our pastures has increased in no less proportion during the past two centuries, and always by the application of methods created by science; and, by virtue of what those methods have accomplished, animal food has been made accessible to our workmen and peasants, to whom it was unknown sixty years ago. By virtue of discoveries in chemistry, sugar, a rare and exceptional luxury in the last century, is now produced in colossal quantities, and has become one of the usual foods of the people. It would be easy to extend indefinitely this enumeration of the ameliorations of the conditions of life achieved through science.

Now all these advances, I repeat, are not due to dialectic or literary discussions, but to the positive discoveries of the physical, mathematical, and natural sciences. I do not mean merely practical discoveries made empirically, but the chief part of this progress is attributable to the highest theoretical conceptions of the positive sciences. Thus all the modern industries of metals, stones, wood, work in materials of every sort, rest upon the general discoveries of chemistry and mechanics. So with the immense development of ways of communication, which every one admires and acknowledges has opened indefinite domains to commerce and industry. It has permitted a general distribution of products and wealth among all civilized peoples, while it has at the same time tended toward a certain continuity of the ideas and the intellectual and moral education of the nations. The last is a capital point, for it is the fundamental characteristic of science to belong particularly to no sect and no nationality, and to be the general domain of mankind.

It is important to recollect how this distribution in common of all the resources of the globe, which has resulted from the development of the ways of communication, has been realized. We should never forget that it is through the discoveries of astronomy that the course of ships across the ocean is directed with certainty, and that the general plan and detailed map of the

continents and islands can be traced with an exactness hitherto unknown; that the findings of modern physics have revealed the theoretical laws of vapors and thermodynamics, which are applied daily to supplement and multiply man's labor in all industries; that the discoveries of chemistry respecting gases, combustion, and the preparation of iron and steel, added to the inventions of rational and applied dynamics, control the fabrication and operation of our machines, ships, and locomotives. In short, these marvelous advances have been accomplished through science alone, and not through a blind empiricism. I will not here dwell upon the wonderful facilities that have been given to life by such subtle discoveries of the physics of our time as the electric telegraph, the telephone, photography, and electric lighting; and I only refer by way of a reminder to the complete modification of the conditions of war effected through the very recent discoveries of science concerning explosive matters. I can not, however, pass in silence over the prolongation of human life, the mean duration of which has been doubled among civilized peoples during the past two centuries by the discoveries of physiology, hygiene, and medicine, in which some new advance is marked nearly every day.

All this progress and all this transformation of life have not been accomplished and will not be continued by chance or accident, but are the fruits of modern science. And this is why public opinion is every day demanding an increasing intervention of the methods and teaching of science in public instruction. This participation is, furthermore, not destined to be for the profit of the community alone, but by a necessary consequence is primarily profitable for individuals to whom, prepared by scientific instruction in their secondary education, it is all the time opening new professional careers.

While the necessity of science in secondary education is thus demonstrated by the most imperative reasons from the material and social point of view, it must not be supposed that science is less well adapted to the mental and moral education of the individual, and that it can not form minds capable of elevated conceptions and develop good citizens.

There are two courses in science corresponding to different aptitudes, but not contradictory—the mathematical course, deductive and rational, and the physical and naturalistic direction, founded on observation and experiment, combined with reason. Mathematics gives the young man a clear idea of demonstration and habituates him to form long trains of thought and reasoning methodically connected and sustained by the final certainty of the result; and it has the further advantage, from a purely moral point of view, of inspiring an absolute and fanatical respect for the truth. In addition to all this, mathematics, and chiefly algebra and

infinitesimal analysis, excite to a high degree the conception of the signs and symbols—necessary instruments to extend the power and reach of the human mind by summarizing an aggregate of relations in a condensed form and in a kind of mechanical way. These auxiliaries are of especial value in mathematics, because they are there adequate to their definitions, a characteristic which they do not possess to the same degree in the physical and mathematical sciences. There are, in fact, a mass of mental and moral faculties that can be put in full play only by instruction in mathematics; and they would be made still more available if the teaching was directed so as to leave free play to the personal work of the student. Mathematics is the indispensable instrument of all physical research. But the physical sciences introduce new and most important elements into education. They rest chiefly upon other methods than mathematics, the teaching of which contributes to the evolution of the child and the manifestation in him of new faculties no less essential, mentally and morally. I mean the faculties of observation and experiment, the object of which is the knowledge of Nature, a thing which, different from geometry, is not acquired by reasoning. In the physical sciences we are slaves to a truth which is exterior to us and which we can not know except by observing it. The teaching of facts is worth most here, and should be given from the tenderest infancy. On this side, scientific teaching, and especially natural history, are necessary from the first years of secondary instruction, and it is a great mistake, I believe, to postpone it till the later years of study. Nothing is more suggestive or better fitted to develop the taste for the knowledge of things and for comparing them than the study of zoölogy and botany. Children acquire very early the fancy for collections, and morphological notions, so useful for the development of the arts and sciences, enter their young minds, we might say, insensibly and without forcing. They acquire at the same time the general idea of classification, which plays a very important part in all human knowledge, and the still more general one of the harmonious combination of organic systems into living beings. A delicate æsthetic sentiment thus gently insinuates itself into their minds.

In order that the elements of the natural sciences may have their full educational virtue, it is indispensable that they shall not be presented to children under the form of arid nomenclatures, dictated and learned by heart as a kind of task; a method very well fitted to give them a disgust for these sciences, which are, on the other hand, really most interesting and most entertaining. The teaching of natural history should be based on the sight of the objects themselves.

The teaching of the experimental sciences, such as physics and

chemistry, should follow. It can not well be given before the period of youth, and should be associated with at least an elementary degree of knowledge of mathematics. Such teaching, properly presented, is adapted in the highest degree to shaping the intelligence and morals of the young man; because it furnishes him at once the precise idea of positive truth, that of the fact proved *a posteriori*, and the most general notion of natural law, or the relation between particular facts, which is determined not by reason or dialectics but by observation. Truth thus imposes itself with the irresistible force of an objective necessity, independently of our desires and our will. Nothing is better adapted than such demonstration to give the mind that modesty, seriousness, steadfastness, and clearness of convictions which raise it above the suggestions of vanity or personal interest, and are closely connected with the idea of duty. The habit of reasoning and reflecting on things, inflexible respect for the truth, and the obligation of always yielding to the necessary laws of the external world, communicate an indelible stamp to the mind. They accustom it to respect the laws of society as well as those of Nature, and to conceive of the rights of another and respect for him as a form of one's own duty and of his own personal independence.

Thus science plays a most important part in the mental and moral education of man. Besides forming useful citizens it makes men free from the prejudices and superstitions of former times. It teaches them how to combat the fatal forces of Nature by labor and will power, resting on the knowledge and direction of the natural laws, rather than by mystic fancies. Hence science forms free spirits, energetic and conscientious, more efficaciously than any literary and rhetorical direction. When scientific education shall have produced all its effects, politics too will be transformed, as industry has already deeply been. Both will become, to use a familiar term, experimental.

Furthermore, and contemporaneously with this recognition of the laws of phenomena, observation and experiment give power over Nature. Through this fact, more than any other, youth can be engaged and drawn by an unconquerable enthusiasm into a really scientific education. To control physical and moral evil in industrial as well as economical life, to strive to diminish suffering, poverty, and misery of every kind, and to make the effort by virtue of the immanent laws of things, was the generous aim of philosophers of the eighteenth century, and they depended upon scientific conceptions, as they unceasingly proclaimed, for the attainment of it. The same end should be sought in our new education, and thereby science will become fully educational.

Scientific education has therefore its own peculiar virtue, and it is by a deep misconception of its character and effect that the

assumption has been made of reserving the monopoly of the full development of the mind for literary instruction. Literary education has hitherto found its highest and most efficient formula in the teaching of the ancient languages. The teaching of the modern languages is less efficient because modern literary culture was derived from ancient culture, and is still, in principle at least, subordinate to it. However brilliant and original our modern systems may be, they have not produced, in either literature or the arts, superior models to those of ancient, particularly Greek, culture. So far, then, as the essential object proposed in secondary instruction is the formation of cultivated minds, there is no reason for expecting equivalent results from the simple substitution of the teaching of living for that of the ancient languages. But a purely literary teaching, even if it preserves its form and intention, does not adequately meet the needs of modern societies. Everybody, even the most enthusiastic partisans of literary studies, demands the addition of a certain amount of scientific teaching as a subordinate affair, comprising at least the elements of the sciences, to which no cultivated man of our age has a right to remain a stranger, whatever place he may propose to take in society. We may go still further, for it is certain that the formula of classical literary teaching, even as thus comprehended, is not adequate to all the careers and fundamental needs of our period. A very large number of citizens demand another discipline, based on a more thorough knowledge of the sciences, which have become indispensable for practical life, as well as for the general direction of society. Human society does not live on art and literature alone, as it once did; it now lives more on science and industry. Hence the necessity for a scientific not less than for a literary teaching, not only from the practical point of view but also from that of mental and moral culture, and these should be given parallel with one another. This scientific teaching should not be exclusive any more than the literary teaching; and it should be complemented by a subordinate literary teaching to which no cultivated man should be a stranger. The ancient languages are not indispensable for the realization of this special kind of literary teaching, because it no longer constitutes the fundamental object of the new organism.

Two parallel courses of instruction, endowed with the same prerogatives—one founded essentially on ancient letters, with the addition of some scientific culture; and the other based on science, to which some modern literary culture is added—that appears to me the most desirable formula of our time, and that to which we are destined to be led by the force of events.—*Translated for the Popular Science Monthly from the author's book, Science et Morale.*

RICHARD OWEN.*

By President DAVID S. JORDAN.

EIGHTY years ago in America the feeling was becoming general that the age of competition was past, and that a new social and industrial era was about to begin. Benjamin Franklin held that if every man and every woman should work for three hours a day at something useful, poverty would be banished, and each one might spend every afternoon of his days and the whole afternoon of his life amid the consolations of philosophy, the charms of literature, or the delights of social intercourse. In the words of Robert Dale Owen: "Every one looked forward to the time when riches, because of their superfluity, would cease to be the end and aim of man's thoughts, plottings, and lifelong strivings; when the mere possession of wealth would no longer confer distinction—any more than does the possession of water—than which there is no property of greater worth."

William Maclure, a wise man and a learned geologist in those days, refused to invest money in the city of Philadelphia, giving as a reason that "land in cities can no longer rise in value. The community system must prevail, and in the course of a few years Philadelphia must be deserted, and those who live long enough may come back here and see the foxes looking out of the windows."

It is not strange, therefore, that Robert Owen, of Lanark, fresh from contact with the reforms in the Old World, and full of projects for the development of the New, found in William Maclure an ardent disciple and active co-worker.

Owen and Maclure did not overestimate the power of co-operation in the struggle of humanity with Nature, but they did overlook the fundamental law of Nature that co-operation means working together, and equality of reward must imply some degree of equality of effectiveness. "The fatal error" of the New Harmony Community, according to Robert Dale Owen, lay in their failure to recognize this law. No "industrial experiment," he continues to say, "can succeed which proposes equal remuneration to all men, the diligent and the dilatory, the skilled artisan and the common laborer, the genius and the drudge. . . . Such a plan of remunerating all alike will ultimately eliminate from a co-operative association the skilled and industrious members, leaving an ineffective and sluggish residue, in whose hands the experiment will fail, both socially and pecuniarily." In other words,

* So far as I know, Dr. Richard Owen, of New Harmony, was not related to the famous comparative anatomist in London who bore the same name.

no community can succeed in which the drones and the workers have equal access to the honey cells.

But though the project at New Harmony, judged by the measure of its founder's purposes, was a failure, still the influence for good of the men who, as a result of the experiment, became part of the life of the infant State of Indiana, is incalculable. New Harmony was located far in the backwoods, in the long-despised county of Posey, but for a time it was truly the center of American science, and to this day few names in the annals of our science are brighter than those of Le Sueur, Say, and the Owens.

To gain a just appreciation of the scientific career of Richard Owen we must consider for a moment the lives of the men of science whose dreams and projects he shared, and who were the companions of his youth. It was through the agency of William Maclure that most of these were drawn to New Harmony. Maclure was a geologist of note and an earnest student of social science. On leaving Philadelphia he planned to conduct at New Harmony a school of industry where the arts of the conquest of Nature should be taught to all. The essence of human progress, in his thought, was the increase of human knowledge. The farmer should cease to be a mere tiller of the soil, and should be trained to make the earth his benefactor. A man is better unborn than untrained. An unskilled laborer is a deformity, and they who toil should do so to the best advantage.

William Maclure published fortnightly at New Harmony a magazine called The Disseminator of Useful Knowledge, containing Hints to the Youth of the United States, from the School of Industry. Its motto was, "Ignorance is the frightful cause of human misery." Its subscription price was one dollar a year in advance.

This magazine was filled with wise reflections on social and political matters, having for lighter reading scraps of science and bits of useful information of every sort.

In the pages of the Disseminator the name of Thomas Say often appears. Say wrote on the shells of the Wabash. He followed Maclure from Philadelphia, and came down from Pittsburg in a keel boat, along with the notable company famous in the New Harmony Community as the "boat-load of knowledge."

Thomas Say had been with Long's expedition across the Rocky Mountains, and had already won fame as a naturalist and traveler. His papers on shells and insects were widely known. These investigations he continued at New Harmony. A close and conscientious observer, his work bears the stamp of a master mind. At his death in 1835 it was asserted that "he had done more to make known the zoölogy of this country than any other man." With a touch of his own modesty, one of his friends said that

"he will be remembered ever as one who did honor to his country and enlarged the boundaries of human knowledge." A worthy monument stands to his memory over his burial place at New Harmony.

One of the most attractive of our pioneer naturalists was the artist, Charles Alexander Le Sueur, who was a native of France, but had lived for a time in Philadelphia, from which place he came to New Harmony in the "boat-load of knowledge." But before leaving France his fame had become widespread. He enjoyed the friendship and correspondence of Cuvier. He had been around the world as a naturalist in the celebrated voyage of Péron. He was one of the most careful of observers and had singular skill in drawing and painting animals. The turtles and fishes were his special subjects of study, and his pictures of them are among the most lifelike ever published. He had been the first naturalist to study the fishes of the Great Lakes and the first to examine the great group of fishes called suckers and buffaloes. He made large collections of the animals of the Wabash Valley, which he sent to Cuvier, and which are still preserved in the museum at Paris. A number of his water-color sketches remain; one, a small but very lifelike portrait of the old Governor Francis Vigo, I have seen in Indianapolis. Le Sueur painted the drop curtain of the theater at the Community Hall. It represented the Falls of Niagara, and to heighten the Americanism of the scene he painted by the side of the Falls that other great wonder of the New World, the rattlesnake.

When the community disbanded, Le Sueur returned to Philadelphia, earning thereafter, it is said, a precarious living by giving lessons in painting. Afterward he returned to France, where he became curator of the museum at Havre. Richard Owen was a great favorite with Le Sueur, and I have already published in these pages Owen's account of him and of the days when as a boy he waded barefooted in the bayous of the Wabash to gather mussel shells for the naturalist.

Dr. Gerard Troost, a Dutch geologist, was also a member of the community, and after leaving it he became State Geologist of Tennessee. He made a magnificent collection of minerals, which was purchased, it is said, by a society in Louisville for thirty thousand dollars.

Dr. Joseph F. Neef, a blunt, plain-spoken, honest man, was the teacher of New Harmony, and he was a great favorite with his pupils. He was born in Alsace, and in his early life had been both priest and soldier. He was a mathematician of great ability. After leaving the army he became an associate of Pestalozzi in his school near Yverdun in Switzerland. He was mentioned by Pestalozzi as an earnest, manly worker who did not disdain to

occupy himself with the elements of science. Neef left Switzerland for Paris to introduce there the system of Pestalozzi. In Paris he met Maclure, and was induced by him to come to America. "It is my highest ambition," said Neef, "to be a country school teacher amid a hardy, vigorous community." And this he became in New Harmony.

He was an intimate associate of the Owens. His daughter Caroline became the wife of David Dale Owen, and Anne the wife of Richard.

There were besides these, who were a part of the community, other men of note in science who spent longer or shorter periods in the community as visitors. Among them was the eccentric, "mattoed" Rafinesque, whose stay was so short and whose story so long that I must pass him by with a word. Sir Charles Lyell was for a time the guest of the Owens.

Reared among such surroundings, and with such men as friends and teachers, it is not strange that the sons of Robert Owen were imbued with a love of Nature, nor that they formed high ideals of the work they should do in life.

Robert Owen, in accordance with his own theories, gave his children the best education which the world could offer, and they made good use of their opportunities. Robert Dale Owen, the eldest son, had a strong taste for philosophy and literature, and was long known as a charming essayist, one of that circle of writers who gave to the Atlantic Monthly its high literary character. He too was a part of the "boat-load of knowledge" and took an active part in the affairs of the community. He became a member of the State Legislature, and exerted a powerful influence in shaping the school system of Indiana. He must ever remain one of the prominent figures in the history of the State.

William Owen, the second son, died early at New Harmony.

David Dale Owen was the third son, and Richard Owen the youngest of the family. These two were intimately and constantly associated both in their early education and in their later work. They were alike in taste and disposition, and, if we can trust the portraits of David Dale Owen, they were very much alike in personal appearance. They were born at New Lanark, in Scotland, David in 1807, Richard in 1810. They studied first at home under private tutors, and afterward were sent to Hofwyl, in Switzerland, to the famous school of Emmanuel Fallenberg. Later they studied chemistry under the famous Dr. Ure in Glasgow, and in 1827 they came to America together in a sailing vessel, landing at New Orleans. Until 1832, when Richard Owen was twenty-two years old, he had never been separated from his brother for a single day.

David Dale Owen was especially interested in fossils and minerals, and was employed to label and arrange the large collection of Maclure. A part of the collection became his property, and formed the nucleus of the famous Owen Museum, containing some eighty-five thousand specimens. This was purchased by the University of Indiana for the sum of twenty thousand dollars, but it was in great part lost in the destruction of the museum building in the disastrous fire of 1883.

David Dale Owen spent most of his life as geologist in the public service. He was State Geologist of Indiana in 1837. Afterward he undertook government work in Wisconsin and Iowa. He spent five years as United States Geologist in field work in the region beyond the Mississippi. Then in turn he had charge of the State Surveys in Kentucky, Arkansas, and Indiana. He was State Geologist of Indiana at the time of his death, in 1860. His work was admirably and conscientiously performed, and as first State Geologist of several different States he set a high standard of public work which few of his successors have been able to follow. One of the most untiring of workers and most unselfish of men, David Dale Owen has left a deep impression on the history of American geology, and the students in the Geological Department of the University of Indiana are proud to do their work in the building named "Owen Hall."

Richard Owen spent much of his early life as a teacher. He served for a time in the Mexican War, commanding a company under General Taylor. At the close of the war he became his brother's chief assistant, and was the first geologist to explore the northern shore of Lake Superior. For a time he held a professorship in the Western Military Institute in Kentucky, and afterward a similar position in a college in Nashville. This position he resigned to become his brother's successor as State Geologist of Indiana. While engaged in the survey of the State the civil war began, and he became lieutenant colonel of the Fifteenth Indiana regiment, under a commission from Governor Morton. While in camp he read the proof sheets of his last geological report. He took part in the battles of Rich Mountain and Greenbriar, and was promoted to the rank of colonel of the Sixtieth Indiana regiment.

The following facts regarding the war record of Colonel Owen I quote from an address by Judge R. W. Miers, one of his students: "In the winter of 1861–'62 he guarded at Indianapolis four thousand prisoners captured at Fort Donelson. In the spring of the following year he was ordered to Kentucky, where his regiment was taken prisoners of war by General Bragg at Mumfordsville. Three months later they were exchanged. Although the regiment was paroled, Dr. Owen was not, nor were his side arms

taken from him. On the contrary, General Buckner went out into the field where the regiment was guarded, and thanked Colonel Owen for his kindness to the four thousand Fort Donelson prisoners at Camp Morton. He was treated very politely by General Bragg, with whom he had become acquainted in the Mexican War."

Later Owen was in the battle of Arkansas Post, and took part in the campaigns of Sherman and Grant about Vicksburg. He was with General Banks in 1863 on the Red River campaign, and while thus engaged was elected by the trustees of the University of Indiana to the professorship of natural science. He accepted the position on condition that his place should be temporarily supplied till the end of the war.

On January 1, 1864, he assumed the duties of his professorship in the university, which he continued to fill for fifteen years. In June, 1879, at the age of sixty-nine, he resigned, an increasing deafness, the result of sunstroke, having made his college duties burdensome to him. He retired to his estate at New Harmony, where he lived until March 25, 1890. His death was a tragic one, caused by accidentally drinking a quantity of arsenical embalming fluid.

While connected with the university he continued his work for the United States Geological Survey, exploring New Mexico and Arizona. During 1869 he traveled widely in Europe and America.

Of Dr. Owen's work as a teacher I may speak briefly. Under the present system of elective study he would have been an ideal teacher, earnest, thorough, and inspiring. Under the old system his best powers were never called for. He had neither skill nor taste for the work of drill master. He taught those well who cared to learn. He believed in large freedom of the student. His students were on their honor, and those who had no honor abused their freedom. It was part of the vicious system which prevailed in our colleges in the last generation that learned men capable of the highest work, and full of the inspiration which comes from thorough knowledge, should be compelled to spend their time and strength in crowding the elements of various subjects upon unwilling and unresponsive boys. A teacher should have the opportunity to give the best that is in him, and to give this to those who are ready and worthy to receive it.

In 1872 Dr. Owen was elected President of Purdue University, the agricultural and mechanical college of Indiana, established under the Morrill Act. This position he accepted, but, as after two years the school still remained unorganized, he never assumed the duties of the office. He published an interesting report to the trustees on the proposed method of organization and government

of the new School of Agriculture. Its discipline he had planned to place in the hands of a representative senate of students. The lower classes were to be divided into sections, each numbering ten to fifteen, and each section to be under the direct supervision of some member of the senior class.

Dr. Owen's scientific publications were very numerous. His favorite subjects were the significance of the contour of continents and the causes of earthquake action. His mind was especially attracted to the study of hidden causes in the development of the earth—that is, to those causes which we have not yet learned to associate with their effects. This difficult line of research involved a vast amount of reading in every tongue, and the breadth of his early education made such reading possible. His first important work, A Key to the Geology of the Globe, was an endeavor to show that the present features of the earth are all the results of fixed and demonstrable laws, like those governing the development of animals and plants. He believed that the earth was a great magnet, made so directly or indirectly by the heat of the sun. As a result of this, he thought that the axis and coast lines of both continents tend to conform to the axis of the ecliptic. The angular distance of twenty-three and a half degrees, which marks the northward extension of the sun in summer, he took to be a natural unit of measure in the structure of the earth.

Whether these relations are real or fanciful I have no means of knowing. Perhaps in the ultimate progress of science it does not matter, for many hypotheses must be framed and tested before we come to the full measure of the laws which regulate the changes in the earth's crust.

Dr. Owen was a gentle and reverent man, unassuming and unselfish in all his relations—a man of perfect courtesy of manners because of perfect courtesy of thought; a man whom everybody loved because his love went out to every one. He was the highest type of teacher, of naturalist, of scholar, of soldier even, because above all his was the highest type of man.*

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* The writer once gave a lecture at New Harmony in the old building which had been the Community Theater. Dr. Owen presided. He was then nearly eighty years of age and very deaf. He did not hear one word of the lecture, but he had the art of appearing to hear. To every point the speaker or the audience deemed good he responded with a smile of appreciation, the expression of perfect courtesy, the courtesy of the "gentleman of the old school," of which type Dr. Owen was one of the most perfect examples.

Editor's Table.

PERNICIOUS LEGISLATIVE ACTIVITY.

THE past winter has probably been the most remarkable on record for legislative activity. Although a considerable number of Legislatures has not been in session, owing to the adoption of the biennial system, those that have been at work appear to have spared no effort to give evidence of their wisdom and to add to the enormous volume of statutes that overwhelm lawyers and judges. In New York State the phenomenal record made by the previous Legislature was broken. Over thirty-five hundred bills were introduced in the Senate and Assembly, and of these over a third of them passed both Houses. Although figures are not at hand in regard to the activity of other Legislatures, the newspaper reports of their proceedings leave the impression that they have not been less productive.

It is not difficult to account for this remarkable phenomenon. Ever since the civil war, which gave a tremendous impetus to legislative activity both at Washington and at the capitals of the States, there has been shown a tendency to rely more and more upon laws to curb unamiable traits of human nature and to improve economic conditions. The old belief in the potency of Yankee energy and thrift to overcome the obstacles of life and of public opinion to bring wayward people into line with the best moral thought of the age has become much weakened. What has affected it most unfavorably of late is the business paralysis of the last few years. The result is that few people entertain the notion that anything can be done in the direction of either moral or industrial improvement without the enactment of some law.

Only a careful inspection of all the bills introduced and passed would enable one to make an adequate analysis of the subjects that have received legislative attention and treatment. But the accounts given of them in the newspapers indicate clearly enough their general character and tendency. They show a growing lack of respect for individual and corporate freedom and for the rights of property, especially the property of rich men. They appear to be based upon the theory that progress lies in the direction of regulating more and more the conduct of everybody, and of taking the money of the people that have it for the benefit of those less fortunate. But no argument is needed to show that this is despotism, although it is created in the name of the people, and that it is a reversion to a much lower state of civilization than the one to which the American people are supposed to have reached. Until this truth is realized, it is probably too much to expect that there will be any amendment of this deplorable evil of over-legislation.

The subject that has perhaps received the most attention is trusts. With many legislators it has been a kind of mania. As a consequence, a mass of bills has been proposed to regulate all large combinations of capital, from railroads and insurance companies to department stores—a new object of legislative hostility—and to increase to the furthest limit the burden of taxation put upon them. Although this mania has not been confined to any particular locality, Kansas and Oklahoma have

been the worst victims. So unfavorable to capital has been some of the legislation of Oklahoma that the home offices of insurance and loan companies outside of the State have ordered their agents to take no more business. The possibility of such a result in New York State had doubtless much to do with the modification of similar bills at Albany.

Naturally, where there has been such a shameless disregard of the rights of corporations, little consideration has been shown for the rights of individuals. When a wave of despotic repression passes over a community it shows no favor; it treats all alike. One of the most characteristic bills of this class is that compelling school teachers to contribute a certain percentage of their salaries to a retirement or pension fund, to be managed by the municipalities in which they live. It is, of course, nothing less than a step toward the establishment of a system of civil-service pensions like the one that now exists in certain countries in Europe. The legislation against the wearing of hats by women in theaters, against playing football, against the organization of Greek-letter fraternities in State-aided institutions, etc., is equally worthy of the same despotisms.

It would be interesting to speak more at length of other legislation, proposed and enacted, such as the prohibition of gold contracts, the issue of scrip as money by State and county governments, the payment of bounties on agricultural products, and the exemption from taxation of certain manufacturing industries. Measures of this kind are sufficiently significant to merit special comment; they illustrate in a striking manner the growing tendency to interfere with private rights and to plunder one class for the benefit of another. Equally significant also is the New York State law to pay to every indigent family a certain sum for the care of each child; it is a practice that can not fail to revive in this country all the shocking social and economic evils of the old English poor law. Finally, it would be interesting to dwell upon the vicious assaults that have been made in New York, Illinois, and elsewhere upon civil-service reform; they indicate the same decadence in public opinion as to the requirements of good government that may be observed in the renewal of archaic legislation in the field of morals and economics.

But it is only possible to call special attention to the efforts made very generally to provide money to meet the alarming increase of expenditures that has followed the large addition to the duties of the State. Desperately pressed to discover new sources of income, legislators have resorted to many novel and extraordinary expedients. Of these the most iniquitous is the graduated inheritance tax enacted in New York and proposed in other States. Not only does it violate the fundamental principles of taxation, namely, uniformity and equity, but it is likely to serve, like all iniquitous legislation, as a precedent to violate still further the rights of individuals and of property.

THE POSTAL UNION CONGRESS.

THE city of Washington is at this moment the seat of a congress strikingly different in character from the Congress which we are accustomed to associate with the national capital. It is a congress of men chosen for their competence to deal with a particular subject. It meets for a business purpose. It will attend to that business. It will attack difficult work and keep at it till it is done. It will not be the scene of vain eloquence, nor yet of party

maneuvers, and will know nothing of log-rolling for appropriations. When its labors are concluded the result will be recognizable in rules established, disputed questions settled, methods of procedure improved, distinct advantages gained for the whole civilized world. It will afford an example, as previous congresses of similar nature have already done, of what can be accomplished by the mutual counsel and concerted efforts of a body of men chosen expressly for their recognized fitness to deal with the interests committed to their charge. If it does not teach a lesson as to the improvement which might be effected in legislative bodies could their members also be chosen on grounds of fitness and competency for the work of legislation, it will not be because the lesson is not sufficiently on the surface.

The congress referred to, as our headline shows, is that of the Universal Postal Union. The formation of the Postal Union may be regarded as marking the transition from a period of semibarbarism in postal matters—that is to say, from an international point of view—to a period of civilization. Prior to 1874 each nation followed its own devices so far as postal arrangements were concerned. There was no attempt at uniformity of postage rates or regulations, and all international relations were complicated in the highest degree. The postage charges to no two countries were the same; or, if they were the same, it was by accident. There was no accident, however, about their being high. It had not occurred to anybody as yet that there could be such a thing as cheap international postage. It seemed to be an accepted axiom that, if correspondence was carried on across a frontier, it must be made an expensive affair.

A far-sighted German, however, the late Herr von Stephan, of Berlin, conceived the idea of introducing order into this postal chaos. He did not see why, if uniform rates could obtain through the extensive territories of a single state, uniform rates might not also be established over the civilized globe. He saw no sense in international frontiers in postal matters. A letter, he held, should be free to go whithersoever its sender willed, at the lowest charge compatible with reimbursement of the expense of conveyance. And as, in the main, the correspondence which each country would send to any other country would be about equal to what it would receive therefrom, he saw no necessity for international accounts. The result of the communication of these ideas to a number of the leading postal administrations of the world was the summoning in the year 1873 of the Berne Conference. The result of the conference was the establishment of the Postal Treaty of Berne, to which the leading nations of the world were signatories. That treaty established a uniform international rate of five cents for a half-ounce (fifeen gramme) letter, with a provisional permission to levy a surcharge up to five cents more on correspondence addressed to very distant countries, and subject therefore to specially heavy "transit" rates. International accounts were in the main abolished. There were still, however, complications, arising from the fact that a great many countries were yet outside the Union, and that accounts had therefore to be maintained with these, and certain debits and credits in connection with their correspondence to be passed on to other countries.

As time went on, however, things simplified themselves gradually. One by one the outlying countries fell in; and at the present time there

is no government on the face of the earth deserving the name of civilized that has not adhered to what is justly styled the "Universal Postal Union." Nearly all countries have voluntarily abandoned their privilege of surcharging letters for remote destinations; so that, broadly speaking, the whole world may be described as one postal territory, while a five-cent stamp is the talisman that will secure for a letter conveyance, from any point where it can be posted, to any other at which it can be delivered by postal agency. For that very low payment it may go half round the globe; and if the person addressed is not there, it may complete the circle in order to find him. The great empire of China is preparing to fall in with the scheme, and has already adopted it to a considerable extent. Japan became a full member of the union many years ago.

The task, therefore, of the postal unification of the globe may be said to be all but accomplished. One or two difficulties in the working of the system remain to be smoothed away, and these are engaging the attention of the present congress. The most important question is that relating to "transit" postage. Some countries are so situated geographically that they are required to handle far more correspondence for other countries "in transit" than those countries have any opportunity of handling for them, while the situation of others, again, is the exact reverse. France, Italy, and Belgium are countries of the first class, a vast volume of correspondence for the continent of Europe passing through France and Belgium, and most of the correspondence of Europe with the East passing through Italy. Great Britain is an example on the other side, the postal business it does with foreign nations far exceeding the use made of its territory by mails in transit. The consequence is that every year in the settlement of claims and counter claims Great Britain has to pay out nearly half a million dollars more than she takes in.

Heretofore these claims and counter claims have been established by means of statistics taken periodically, and the question now before the congress is, Can these statistics, which entail a vast amount of labor, and more or less impede the postal service while they are in progress, be got rid of altogether? The German post office has a scheme by which this object can be accomplished. The plan is briefly this: As the taking of the statistics costs a great deal of labor, which, of course, means money, it is proposed that countries having a less claim in the general clearing than ten thousand dollars a year should forego it altogether in consideration of getting rid of trouble and expense to that (supposed) amount, and that the same amount should be deducted from all claims exceeding ten thousand dollars. It is estimated that the making of these deductions would decrease the total amount to be paid by the debtor countries by twenty-five per cent; and, taking the latest statistics as a basis, it is proposed simply to assess each debtor country accordingly, and pay over to each creditor country the amount to which it is entitled. If this scheme commends itself to the congress, the international postal system will have reached nearly the acme of simplicity, all postage accounts between the different countries having been swept away into the limbo of the obsolete and the useless.

To how great an extent such an organization as the Universal Postal Union makes for civilization and for international unity it is needless to point out. It is one phase of the federation of mankind, and gives ground

to hope that other steps in the moral unification of the race will follow. It is satisfactory to think that it is to a large extent the result of individual effort. The different governments of the world have been rather passive than active in the matter. They have had the grace—and they deserve credit for it—to let the best heads in their several services cooperate in developing this great scheme, which deserves to be regarded as one of the most definitive steps in advance that civilization has ever taken. When the proposition was first made it was not looked upon with great favor in more than one high quarter, but, as it did not involve much expenditure of money, no serious obstacles were thrown in the way. The thinkers who had it in hand soon showed what could be made of it, and to-day the world is reaping the benefit of their labors and their sagacity. As we began by saying, the congress of this world-wide union is a congress of the competent—let us add of the responsible. As it happens, these are precisely the two adjectives that are least applicable, generally speaking, to the members of political assembles elected by popular vote. As to competence, there is no need to discuss the matter; as to responsibility, it means nothing in political circles save liability to censure and rejection on the next occasion, if the representative has not pushed local interests with sufficient vigor and sufficient disregard of wider considerations. It would be vain to look for any sudden change in the working of democratic institutions; and yet an object lesson like that afforded by the Congress of the Universal Postal Union is one that should not be wholly lost on reasonable men.

Scientific Literature.

SPECIAL BOOKS.

THOSE interested to learn of their paleolithic and neolithic ancestors will find an interesting account of their conditioning in Prehistoric Man and Beast.* Although embodying the results of recent geologic and archæologic research, the book is not at all technical, but adapted to the popular reader. If he knows anything of scientific theory, he may be aroused by the epithets applied to the cherished hypotheses of some writers. The great ice sheet is called "a myth," the polar ice cap "a monstrous fiction," and the astronomical theory of an ice age receives no milder treatment in the chapter devoted to the discussion of the subject. But, having dealt as an iconoclast with these favored cults, the author writes of the lore of fairyland in an opposite fashion. Fairies are not legendary beings, but real folk, whom scientific people "may no longer dare to despise." The small, tricky natives of an island off the Schleswig coast were called Pucks, and even mermen and mermaids had their prototypes in a Finnish people who dressed in sealskins and were taken by the Shetlanders to be half human.

The record of primeval man is not found in documents produced by impressionable minds, but is registered in the river gravels, cliff caverns,

* Prehistoric Man and Beast. By Rev. H. N. Hutchinson, F. G. S. New York: D. Appleton & Co. Pp. 298, 8vo. Price, $3.00.

kitchen middens, and long barrows. In these ancient dwelling places the weapons, utensils, ornaments, burial and hearth stones testify unerringly as to his mode of life. The degree of skill attained in his handiwork serves as a basis to differentiate the earlier races from those of later times. Men of the older stone age fashioned their weapons and tools in the rudest manner from rocks, merely chipping the edges. In the succeeding period, the neolithic, they had learned how to finish them by grinding; while in the bronze and iron ages they discovered the use of metals. It is somewhat remarkable that while it is a disputed point as to whether paleolithic man possessed a bow, it should be a well-attested fact that his wife used bone needles and knew how to sew.

These authentic sources of knowledge concerning our early ancestors are not the only data to be studied. Primitive races exist whose habits indicate what prehistoric man may have been like, and the author pleads, "It is sincerely to be hoped they will not be improved off the face of the earth before we have learned all that they can teach us about the past."

Nothing definite is known concerning the place of man's first appearance on the earth, but probably the northern hemisphere of the Old World can claim the honor. This may have occurred fifteen or twenty thousand years ago, but the allowance of eighty thousand odd years is deemed an unwarrantable waste of time. The volume contains ten full-page illustrations based upon such details as the researches have furnished. Primeval man, however, is reconstructed without a skull as a model for his features. This feat must have tested the creative power of the artist, but we are assured that even this has been done acceptably to the archæologists, and we can not demur if it does not coincide with our ideal.

About one fifth of *Macleod's History of Economics* is really history.* The rest is exposition of basal principles. Macleod declares that economics should and can be as exact as physical science, and he is putting forth vigorous efforts toward making it so. He says that most of the modern economists' work up to this time has been destructive, but that constructive labors are now urgently demanded and that the ground has been fully cleared for them. His present work opens with an essay on the method of investigation proper to economics. He gives much credit to Bacon for enunciating the principle that physical inductive science must precede and guide moral inductive science and protests against Mill's declaration that induction should not be taken as the method of political economy. Having placed economics among the inductive sciences, our author proceeds to lay down some general principles of reasoning which this position makes fitting for it. "The fundamental concepts and axioms of every science," he says, "must be perfectly general," and "no general concept and no general axiom must contain any term involving more than one fundamental idea." The clarifying of fundamental concepts, in fact, is the chief object of this treatise. The historical portion comes next. He rejects the insular idea that political economy began with Adam Smith, and gives to the French Economists the credit for establishing it as a science, although certain of its principles had been fixed from time to time before them. He states the doctrines of the Economists regarding exchanges, money, wealth,

* The History of Economics. By Henry Dunning Macleod. New York: G. P. Putnam's Sons. Pp. 600, 8vo. Price, $4.50 *net*.

productive labor, and other economic concepts, giving also the opinions held by the Roman and Greek jurists as to what things are wealth. He then discusses the views of Adam Smith, pointing out what he regards as Smith's chief merits and chief defects. In a similar manner the economic doctrines held by Ricardo, Whately, Say, Mill, Bastiat, Perry, and Jevons are critically examined. He also describes his own contributions to the science. In pursuance of his conviction that a great part of the confusion and false teaching in economics is due to lack of clear definitions, he devotes the remaining three fourths of the volume to setting forth the legal and scientific bases of the chief concepts of the science. Among these concepts are acceptilation, accommodation paper, banking, capital, currency, cost of production, credit, debt, exchange, Gresham's law, money, negative quantities in economics, rent, value, and wealth. Each is discussed with considerable fullness, particular attention being given to the early history of the ideas. Macleod is a vigorous and positive writer, and a study of his pages can not fail to substitute exactness for many hazy economic teachings.

With modesty and excellent taste Mrs. *Rogers* has presented to the public, not a fulsome eulogy, but a view of her husband's life as shown in his letters, supplemented only by the necessary biographical facts and a paragraph here and there to explain and connect the matter from his own pen.* Many of the biographical facts she allows the late Dr. Ruschenberger to tell in extracts from his Memorial of the Brothers Rogers. The son of a physician and professor of science, to whose chair in William and Mary College he succeeded at the age of twenty-four, William B. Rogers was early introduced into the field of scientific education, in which he did masterly work up to the last hour of his life. There was not much money available for the support of science in the United States during the thirties, and the teaching and research of Prof. Rogers were carried on with very limited resources. His means, moreover, were frequently drawn upon for the benefit of his brothers, who were struggling in the same field with rather less material success than his. In 1835, at the age of thirty-one, Prof. Rogers was appointed State Geologist of Virginia, and in the same year was called to the chair of Natural Philosophy at the University of Virginia, which he retained until 1853. The geological survey was allowed by the State Legislature to continue for seven years, and furnished the occasion for undertaking what was Prof. Rogers's most extensive contribution to natural science. The letters exchanged between William and his brothers reveal something of the turbulence of hot-blooded students and the paralyzing influence of narrow-minded authority with which many science professors had to contend half a century ago. All the important discoveries and controversies that mark the history of geology in this century are discussed or at least remarked upon in these letters. In the diction of many of the epistles, and especially in that of extracts from several addresses that are inserted in the volumes, we find all the evidence that can be given without his living voice as to the powers of oratory with which Prof. Rogers has been credited. We are especially impressed with the testimony of these volumes to the ability of their subject as an educa-

* Life and Letters of William Barton Rogers. Edited by his Wife with the assistance of William T. Sedgwick. Boston: Houghton, Mifflin & Co. Two vols., 12mo. Price, $4.

tional organizer. This is shown especially in his Plan for a Polytechnic School in Boston, and his labors in furtherance of the scheme, which resulted in the establishment of the Massachusetts Institute of Technology. His grasp of modern educational conditions is shown also in documents which he presented to the Legislatures of Virginia and Massachusetts in behalf of the institutions with which he was successively connected. Ability of the same sort appears in the part that he took in organizing the American Association for the Advancement of Science, the American Association for the Promotion of Social Science, and the National Academy of Sciences. His death in 1882 closed a career of marked influence upon the advancement of science in America.

GENERAL NOTICES.

In order to judge fairly of the key to the problems of the universe furnished by Mr. Silberstein,* it is not only necessary for one with scientific habit of thought to subdue this mental temperament, but to place himself in that receptive frame of mind with which he should attend a *séance* or view an impressionist picture. However easy this may be for the metaphysician, it is almost impossible for the physicist or chemist, who, without his rule of verification, is more helpless than a rudderless ship at sea.

This comprehensive work is well divided into four chapters: The Idea of God, The Creation, Matter and Force, and Universal Mechanism.

As the conception of a machine precedes its manufacture by the mechanic, so the universe in its potential being antedates the physical universe which is individualized from it. The abstract concept of the universe as a whole is absolute intellectuality or God. This conclusion is reached by the *a priori* method of pure reason. The cognition of man, which concerns itself only with the perception of things manifest to the senses, is no knowledge at all. It teaches us nothing of true entities. We observe bread and man as two different things, and also that they are mutually convertible. If they were real existences, "how could they merge one into the other?" Hence "we are forced to assume that the entity of any compound object as it appears within the limits of time is not real. . . . Thus the science of experience and experiments alone, of which our naturalists are so proud, and which they call 'exact knowledge,' is a delusion." All the causes which exist in the universe are bound up together in the knowledge of the causes. If man knows one cause, he knows all causes of eternal existence. Man, however, knows that he does not know, and in this comprehends the whole knowledge of the entire universe. He thus arises to Divinity itself, and human intelligence is identically the same with the one absolute knowledge.

In regard to the Creation, we learn that the universe consists of two kinds of existence, sensual and intellectual. "The existence of any Creator before the creation in time, or behind it in space, is an impossibility." Matter can not contain in itself the absoluteness of existence. Man as a material being is an accident of changeable matter. The creation of the universe is an eternal emanation of the Absolute Intellectuality. The essence of the universe vibrates in spiritual waves. Physical waves, which appear in various forms of energy, magnetism, electricity, heat, and light, are contained in these.

In Matter and Force we are given a *résumé* of the theories of various philosophers from Thales to Spinoza. Many modern philosophies are considered. They differ from that of Spinoza only in their names. "One calls his system Positivism, the other Materialism, the third Skepticism, the fourth Evolution, but they are all one in the Spinoza fanaticism." Among others Newton came, and through his mistaken theory of gravitation "reduced mankind to a still lower degree of pure wisdom." Chemists have also led the world astray with their inductions.

* The Disclosures of the Universal Mysteries. By Solomon J. Silberstein. New York: Philip Cowen, 1896. Pp. 298. Price, $2.

The law of the union of gases is extremely repugnant to the author; "even if proved by ten thousand mathematical calculations, it is yet a natural impossibility, because these calculations are based upon false axioms."

Under the head of the Universal Mechanism the laws of motion are discussed. The property of inertia in matter and the first law of motion are said to be "absolutely false," while the author promises to "entirely annihilate" the force of gravitation. Instead of these, he gives us centrality, "a power of conservation whose impulse is to keep an atom or a body in its peculiar state or form." Inertia is accordingly "nothing else than centrality holding each physical object in its chemical bond. . . . Centrality is an active force, while the force of motion is passive." Another argument is furnished to show that "chemical combination has only to do with the *qualities* of objects." Even if the laws of gravitation were correct, "it would be a natural impossibility that the moon should have an elliptical motion around the earth."

Those who prefer the idealistic to the scientific method of explaining the mysteries of the universe will find the book of interest.

The results of over two hundred experiments on phenomena connected with the X rays have been collected in a volume by *Edward P. Thompson*.* The book is designed for students and workers in electricity, hence no attempt has been made to render it attractive to the general reader. Many of the experiments were made before Röntgen's famous discovery was announced, some dating back to the time of Faraday, so that those who made them of course had no idea of their connection with the X rays. Among the special points that the experiments bear upon are the action of a magnet on the cathode light, photo-electric dust figures, mutual repulsion of cathode rays in the discharge tube, behavior of cathode rays outside the discharge tube, effect of the X rays on various chemicals, and penetrating power of the X rays. We note the following well-known names among the investigators whose work appears in the volume: Faraday, Davy, J. J. Thomson, Crookes, Lenard, Röntgen, Edison, Tesla, and Lodge. The text is illustrated with a large number of reproductions of skiagraphs and other pictures.

The authors of *Curiosities of Medicine* have been working a very fruitful field, and doubtless could have gathered an even larger harvest.* Although medical journals are constantly reporting curious cases of abnormal formation or of recovery after injury, the present volume appears to be the first systematic collection of such material. To the physician a knowledge of such cases may often be of service in indicating what hope there may be for ameliorating similar abnormal conditions that may occur in his practice. To the layman the collection is one of startling and often rather painful interest. Instances of children born joined together, of which the Siamese twins have long been the traditional type, are well represented. With these are classed persons with supernumerary limbs, heads, and other organs. Minor abnormities present a wonderful variety, including albinism, excessive hairiness and hairlessness, elastic skin, horny growths, large or small heads, harelip, congenital absence of limbs, deficient or supernumerary fingers and toes, tails, extra breasts, and malformations of the internal organs. Abnormal forms and functions in the generative organs afford a large volume of curious material. Celebrated giants and dwarfs and other anomalies of size furnish material for a chapter, and there is a group of records of extraordinary longevity. Idiosyncrasies with regard to sound, vision, smell, taste, touch, foods, drugs, etc., endurance of fasting, power of contorting the body, endurance of pain, supernormal strength, etc., make up a long list. Many cases of recovery from unusual forms of injury to various parts of the body are recorded here, and there is much interesting material under the head of anomalous types of disease. The concluding chapter is a record of historic epidemics. A full general index and a bibliographic index are ap-

* Röntgen Rays and Phenomena of the Anode and Cathode. By Edward P. Thompson and William A. Anthony. New York: D. Van Nostrand Co. Pp. 190, 8vo. Price, $1.50.

* Anomalies and Curiosities of Medicine. By George M. Gould, M. D., and Walter L. Pyle, M. D. Philadelphia: W. B. Saunders. Pp. 968, imperial 8vo. Price, cloth, $6; half morocco, $7.

pended. The volume is illustrated with nearly three hundred figures and a considerable number of plates.

An address on *The Railroad as an Element in Education*, delivered at the World's Fair in New Orleans in 1885, by Prof. *Alexander Hogg*, was widely circulated at the time, attracted much attention, and was noticed in the Monthly. It was an honest and forcible attempt to present the benefits the railroads have conferred upon society and the nation, and to antagonize the unreasoning populistic prejudice against them. It showed in a few words appealing directly to public intelligence that railroads have cheapened communication and transportation, have opened remote parts of the country, making them near and accessible, have removed the dangers of local famine, have contributed vastly to the national defense while removing the necessity of keeping large standing armies; and that in view of the services they render and of what is charged for like work abroad, their rates are extremely low. Further, the men who have acquired the most wealth through railroad management have also distinguished themselves by their benefactions to education and other contributions to public welfare. This address is now republished in a revised and enlarged form,* with additional chapters reviewing the development of the ten years subsequent to its original publication. Of these chapters one of the most important is the one on The Inception and History of Strikes, the methods of which are shown to be "wrong in principle and ruinous in practice."

The first volume of Prof. *W. J. Beal's Grasses of North America* † was published ten years ago, and was noticed by us in November, 1887. It was designed more particularly for farmers and students, and comprised chapters on the physiology, composition, selection, improving, and cultivation of grasses and clovers. The present volume supplements the former one to a certain extent, but in most respects it is an independent work. In it the grasses are classified and described, and each species is illustrated; and chapters are added on their geographical distribution, and also a bibliography. In most cases the generic characters closely follow those given by Bentham and Hooker in *Genera Plantarum*. Extracts are given regarding the writings of prominent authorities on the grasses; and also notes regarding the tribes and some of the genera. The author has been permitted to examine, during his studies for this work, the herbarium of Michigan Agricultural College, all the grasses in the herbaria of the University of Michigan and Harvard University (including the grasses of the late Dr. George Thurber), those of the Department of Agriculture at Washington, and those of Prof. F. L. Scribner; and, himself one of our leading botanists, has been assisted by Prof. L. H. Bailey and Prof. S. M. Tracy in the matter of geographical distribution, L. H. Dewey and A. A. Crozier. The work is a real addition to our botanical literature, filling as it does a department that has not before been completely occupied.

Mr. *Thomas D. Hawley*, of the Chicago bar, has prepared and published a new system of logic,* by which, he claims, reasoning can be carried on by an infallible process, even as the interest can be calculated upon a promissory note. The method consists in the repeated use of a few processes which are performed in a mechanical manner, and the results appear automatically. "Its tools are a few simple signs—namely, the capital letters of the alphabet to represent positive terms, the small letters to represent negative terms; the mathematical sign of equality, = for 'is'; a short prependicular mark, | for 'or,' and a square for the 'universe of discourse.' When a square is divided into a proper number of sections it is called a Reasoning Frame. By the use of the Reasoning Frame every proposition which can possibly be made with the letters used is set before us. We then eliminate every proposition which is incon-

* The Railroad as an Element in Education. Revised and enlarged, with New Illustrations. (Special edition). By Prof. Alexander Hogg, Superintendent of Schools, Fort Worth, Texas. Louisville, Ky.: J. Morton & Co. Pp. 112.

† Grasses of North America. By W. J. Beal, Professor of Botany and Forestry in Michigan Agricultural College. In two volumes. Vol. II. New York: Henry Holt & Co. Pp. 706. Price, $5.

* Infallible Logic: A Visible and Automatic System of Reasoning. By Thomas D. Hawley, of the Chicago Bar. Lansing, Mich.: Robert Smith Printing Company. Pp. 659.

sistent with the given proposition or state of facts. The uneliminated propositions which automatically remain in the Reasoning Frame will then give us every iota of truth which our data will yield." Aside from the signs and the device of the Reasoning Frame, the treatise does not appear to differ materially from other good treatises on the subject. The author's explanations are fairly clear. A complete index is an excellent feature.

An unusual and fascinating biography is that of Sir Richard Burton,* the explorer and linguist, written by his niece. One does not know whether to wonder more at the extent of his travels or at his indefatigable industry in language study. The titles of sixty odd books are included in the list of his works, among them being an entire volume of the Royal Geographical Society, translations of Portuguese and Arabic, and several grammars of Hindu dialect. His journeyings were equally varied. We find him dwelling in the far East, in India and Arabia; later, crossing the Andes and pampas, in Brazil and Paraguay; now discovering the lakes in Central Africa, then investigating Utah, or exploring the mines of Iceland. Patient, persistent, undaunted by difficulties, he was admirably fitted by nature for the task of exploration. Had he been equally keen to read humankind, his local success among men might have been greater. Yet he may not have lacked discernment, but the will to be politic. Society is the rather to be arraigned, if, as we are told, "the habit of veracity sadly hindered him at times in his struggle with the world."

There is reason to believe that intellectual American women have somewhat surfeited themselves on the long-forbidden fruit of an education "just like the men's." They seem now to realize that the idea of a "woman's sphere" can have its dignity as well as its limitations, and that the possession of acute perception, clear reasoning ability, and high power of application can be shown in the wholesome and economical provisioning of a family and the efficient management of children and servants no less than in struggles with Greek roots and mathematical operations. The household arts are getting an increased share of attention both in women's clubs and in women's and coeducational colleges. A book now before us embodies a course of lectures on home management delivered in the University of Wisconsin.* These lectures give a general view of the field, presenting what might be called the theory of their subject, and using practical details merely by way of illustration or to give definiteness to the views set forth. After a preliminary chapter on the Statics and Dynamics of Household Economy, Mrs. Campbell considers first the house. These are some of the principles that she lays down as regards building:

> The plan of the house includes beforehand not only all that has been said as to location and its bearings, but also the settling of the cost and an intelligent idea of the special family needs. Here a woman's judgment is absolutely essential. It is the woman who lives chiefly in the house, and who, if common sense were brought to bear, would soon put an end to the type of thing the average builder offers her. Why should we perpetually go up and down when going sideways is so much easier? Why should we accept stupidly planned and inadequate closets or no closets at all, and kitchens in which everything is calculated to bring the greatest unhappiness to the greatest number? The utmost convenience in every inch of working space should be the law. The difference between a pantry opening close to the sink and one at the opposite end of the room may seem a small matter; but when it comes to walking across the room with every dish that is washed, the steps soon count as miles.

With regard to decoration, she urges the claims of the simple and elegant as against the flashy and trashy, and insists that the adornment of a useful article should never interfere with its use. Thus she says: "The pitcher that does not pour well can not be beautiful, though of gold. . . . The spider-legged table and its insect family of chairs—the things that creak when we sit down and tip over when we get up—these are not beautiful." Her treatment of domestic industries in general, the nutrition of the household, cleaning, and household service is in the same line. An excellent list of books for further study is added to each chapter. Lists of subjects for the use of women's clubs in studying household economy and informa-

* The True Life of Captain Sir Richard F. Burton. By Georgiana M. Stisted. New York: D. Appleton & Co. Pp. 419. Price, $2.

* Household Economics. By Helen Campbell. New York: G. P. Putnam's Sons. Pp. 286, 12mo. Price, $1.50.

tion about clubs that have given some attention to this field are appended.

This monograph * gives, in some eighty pages, a list of the published maps of Virginia. The first map, made in manuscript about the year 1585, bears the name of John With, a painter who was sent into the colonies by Walter Raleigh to paint the redskins and the other curiosities of the newfound country. Captain John Smith drew up his famous map in 1608. "In the boundary dispute between Virginia and Maryland in 1873 Smith's map was used as an authority, and prior to that it was the foundation upon which all the maps of Virginia were constructed." From 1608 onward the maps multiply, down to the last one, a railroad pocket guide published in 1893. Specimen reproductions, especially of the quaint older maps, would have enlivened this catalogue.

The greater part of the *Twelfth Annual Report of the Bureau of Labor Statistics of the State of Connecticut* is devoted to the practices prevailing in the various towns and cities of the State with regard to assessments for the purpose of taxation. The bureau has evidently investigated the matter thoroughly, and has discovered considerable foundation for the always current rumors as to inequalities. The information gathered, including suggestions from local assessors, is conveniently arranged, and besides its value within the State may well serve as a guide and model to officials of other States. The bureau has also collected the appraised values of over seven hundred probated estates, finding them to confirm closely the figures given by assessors. For purposes of comparison the tax laws of Connecticut, New York, and Massachusetts are here printed. Other investigations whose results are given in this volume are on the taxation of corporations, the condition of bakeshops, and the wages of factory hands.

A wonderful quantity of information concerning the various materials, processes, and applications of the photographic art is contained in the eleventh *American Annual of Photography* (Scovill & Adams Co., New York; paper 75, cents; cloth, $1). The aid that photography can give in surgery, mining, detecting forgery, etc., is told in special articles. Directions from which the amateur can use his prints to make a number of tasty and pleasing objects are another feature. Work with the X rays and color photography are two important recent developments that find place in the volume. There are also standard formulas, useful recipes, tables of chemicals, of capacities of lenses, of conjugate foci, of enlargement and reduction, of comparative exposures, etc., lists of photographic books and patents of the preceding year, and of American and foreign photographic societies. There are also a full almanac for 1897, postal and patent information, etc., while the large number of advertisements add no little value to the book. The volume contains over three hundred illustrations from photographs of pleasing and interesting subjects.

In his *First Year in German*, Mr. *I. Keller* has sought to avoid the defects and combine the advantages of the grammatical and "natural" methods of teaching the language. His method is simple, and includes practical exercises in which the grammatical features are explained as they occur. They consist of progressive reading lessons, translating from German to English and from English to German, with explanatory notes, oral and written exercises, and conversation exercises, with grammatical paradigms in the appendix. (American Book Company, $1.)

The *Report of the United States Commissioner of Fish and Fisheries for 1892–'93* is accompanied by three special reports of assistants in charge of especial inquiries. One of these deals with food fishes and the fishing grounds, and reports investigations into the physical and other conditions of the inland and coast waters of the United States. Another is occupied with the statistics and methods of the commercial fisheries, and the third details the operations of the commission in propagating and distributing food fishes. Following these is an extended account by William A. Wilcox of the Fisheries of the Pacific Coast, which have recently grown to importance, especially the catching of salmon for canning. The whaling and sealing of the Pacific are also important.

* Virginia Cartography. A Bibliographical Description. By P. Lee Phillips. Smithsonian Miscellaneous Collections.

The volume includes also a report on the work of the steamer Albatross and a descriptive catalogue of the collections of the Albatross made in 1890 and 1891. A number of views and other plates illustrate the several papers. The volume for 1893–'94 contains reports on the same general inquiries as its predecessor, and among its special papers are a description of the exhibit of the commission at the World's Columbian Exposition, The Whitefishes of North America, The Fishes of the Missouri River Basin, A Review of the Foreign Fishery Trade of the United States, and a List of Publications of the Commission from its establishment.

Volume XXX, Part IV, of the Annals of the Harvard Observatory is devoted to a *Discussion of the Cloud Observations* made at the Blue Hill Meteorological Observatory, by *H. Helm Clayton*. Mr. Clayton begins with a historical sketch of cloud nomenclature which introduces his statement of the new systematic nomenclature adopted for the Blue Hill Observatory. The names devised at Blue Hill are designed to specify the form, altitude, and origin of the clouds. After considering briefly the methods of cloud formation and the relations of clouds to rainfall and to cyclones, Mr. Clayton gives an account of the annual and diurnal periods in the wind and the cloud movements that have been found from the Blue Hill observations. Other topics treated are the movements of the wind and clouds at different heights in cyclones and anticyclones, cirrus motions, and the velocity of storms. Some notes on the use of cloud observations in weather forecasting are added, and there is an appendix of tables and diagrams.

G. P. Putnam's Sons are now presenting to the public Volume II of *Books and their Makers during the Middle Ages*, by *George Haven Putnam*. In this new volume Mr. Putnam recounts the vicissitudes of two centuries' books and bookmakers—the trials and triumphs of those first ambitious, determined little companies of printer-publishers who, confronted ofttimes by the mighty odds of church and state, yet wielded so bravely and untiringly their new-found weapon that echoes of their resounding blows for truth and liberty still ring in the ears of men. Mr. Putnam dwells with emphasis and at some length on certain of the early printer-publishers of the Reformation period, selecting as representatives of that class the Kobergers in Nuremberg, Froben in Basel, the house of Plantin in Antwerp, Caxton in Bruges and in London, the Elzevirs in Leyden and Amsterdam, "and the famous families of the Estiennes or Stephani." The author modestly disclaims attempts at dramatic arrangement or presentation of his subjects, saying, as with regard to Luther, that he is "not concerned with Luther as a Reformer, as a fighter, or as a Christian hero, but simply with his work and his relations as an author"; nevertheless, there is much that is of deepest historic and dramatic interest to be found throughout the book. The volume is beautifully put together. With its plain, rich binding of dark red, its uncut linen pages, and clear type, it is a fitting specimen of what books and bookmakers have attained to in this day and age. (Price, $2.50.)

German Scientific Reading, compiled by *H. C. G. Brandt* and *W. C. Day* (Holt), embodies an excellent idea. Students of science taking up German, without caring to linger long over its literature, but wishing to acquire rapidly the facility of reading German scientific prose, will find here an adequate answer to their wants. The extracts, mostly by well-known German scientists, have been chosen for the simplicity of their diction and the value of the information they impart. Covering a wide range of sciences, they might prove as interesting reading to a class of general students as to specialists. Some twenty pages of descriptive prose, by those masters of style, Goethe and Humboldt, enliven the book by their literary quality. The notes are adequate, and the vocabulary "is intended to contain every word in the text, simple or compound, literary or technical." This collaboration of two specialists, professors respectively of German and of chemistry, has produced a Reader that should recommend itself to German teachers and classes in general.

Another portion of Weisbach's great work on mechanics, as revised by Hermann, dealing with *The Mechanics of Pumping Machinery* has been translated (Macmillans, $3.75). It is designed for the use of engineers and students of engineering; hence,

while it gives some historical information about early forms of water elevators, it presents the mechanical side of even the simple bucket and sweep and the Dutch scoop. It is, of course, chiefly occupied with a technical presentation of the theory of reciprocating and rotary pumps, but gives a chapter to such additional water-raising machines as the hydraulic ram, ejectors, injectors, spiral pumps, and the pulsometer. The machines described are depicted in nearly two hundred engravings.

Miss *Sadie F. Price's Fern Collector's Handbook and Herbarium* (Holt, $2.25) is intended as an aid in the study and preservation of the ferns of the northern United States, including the district east of the Mississippi and north of North Carolina and Tennessee. It is a quarto volume, on the right-hand side of each page of which is given a full-size representation of some species of fern (seventy-two species being included), while the opposite page is left blank for the insertion of a pressed and dried specimen of the species. The letterpress consists of directions for preparing and fixing the specimens, the technical description of the order of ferns, and the list of illustrations or of species illustrated.

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Bell, Alexander Graham. The Mystic Oral School. Washington, D. C. Pp. 88.

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Harris, William T. Art Education the True Industrial Education. Syracuse, N. Y.: C. W. Bardeen. Pp. 77. 50 cents.

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Fragments of Science.

Large Trees from the Coal Period.—The approach from the south to La Grange, Ala., is marked by the fine view into the valley of the Tennessee River, three or four hundred feet below, which it presents, and by the masses of sandstone lying around the village, where it has been precipitated from the cliffs above by the wearing away of the limestone under them. But the most interesting and remarkable feature of the locality, says Mr. Henry McCalley, in his geological report of the valley region, and the one for which La Grange will always be distinguished, is the profusion of the remains of fossil plants. Nowhere can one gain better ideas of the magnificence of the flora of the coal period than at this place. Trunks of *Lepidodendron*, two or three feet in diameter, lie buried and protruding from the *débris* of the sandstone. These trunks have in general preserved their form and are not at all compressed, whereby they show that they stood erect in the beds that inclosed them. Although stripped of their bark, the scars are plainly impressed on their surface. Two very fine specimens of these trunks are in the cabinet of the Geological Survey at the State University. One of them represents the lower part of the trunk, and has two large roots attached. The other has been used as a horse block, is about three feet in diameter and four feet high, and is remarkable for the impressions of calamites and other plants of which the sandstone composing it is full. The supposition is drawn from them that, in the process of petrifaction, the interior of the trunk was removed by decay or otherwise, leaving a hollow cylinder of the outer layers of the trunk, and that this hollow cylinder was filled up with sand and fragments of calamites and other coal plants, which subsequently hardened.

The Moki Indians and their Birds.—The Moki Indians are described, in Dr. E. A. Mearns's paper on the names of their birds, as having a superstitious regard for most living things, particularly as holding serpents in reverence and a number of birds as sa-

cred, or as looking to them as representing their clans or secret religious orders. "Observers of Moki ceremonies have seen large wooden tablets in their *kivas* or ceremonial chambers painted with a green ground, ornamented with the rain prayer and some one of the countless Moki gods, and have remarked that the little bird in the clouds suggests the thunder bird of the plains Indians." Bourke remarked upon the constant appearance of feathers, chiefly those of the eagle and turkey. The Indians will not part, for any amount of money, with the wands of eagle feathers used for fanning living serpents at their snake dance, for fear of offending their bird deity. Sacrificial plumes of eagle down, attached to little sticks, are buried in the corners of the field at the opening of spring. The feathers of the parrot, brought up from Mexico, are treasured in the Pueblos, and will always be found, according to Bourke, "carefully preserved in peculiar wooden boxes, generally cylindrical in shape, made expressly for the purpose. With them is invariably associated the soft white down of the eagle. The Mokis have an especial veneration for the two species of eagle, which are kept by them in cages, and are fed largely on field mice and rabbits. Capt. Bourke alludes to eagle feathers as common articles of commerce among these people, to which they attach a determinate value, and ascribes the high price placed upon them by all the sedentary Indians of Arizona and New Mexico to graver considerations than mercantile.

"Wild Indian Corn." — The question whether wild Indian corn is growing in America is raised in Garden and Forest by Robert P. Harris, who assumes that such a corn has been found in several regions of this continent, naturally reproducing itself, and that it has a character of growth that fits it for long preservation in a dry climate, although, if planted and cultivated for a few years, all the characteristics of wildness gradually disappear. "The cobs of wild maize are thin and hard, covered with lines of mushroom-shaped elevations, each having a wirelike pedicel growing from the top, attached to a glume inclosing a small pointed grain, or a flat grain smaller than any pop corn. These kernel husks overlap each other toward the point of the ear, like the shingles on the roof of a house. The imbrications are largest and longest at the butt of the ear, and gradually become less pronounced as they advance in distinct rows to the point. The individual glumes are from an inch to two inches long, and are much longer than this where the grains are not fertilized, particularly if the entire ear is of this character, as is proved by a specimen in my collection. Over these imbrications is the outside husk as we have it in all cultivated corns." Mr. Harris further says that Indian corn in its wild state has been found in Arizona, southern Texas, the valley of Mexico, and Central America. He has known Rocky Mountain corn a long period of time; it has very small ears. One of the professors of the University of Mexico has been experimenting with the wild corn of the valley, and has the engraving of a plant that grew to be about five feet high. Wild corn has also been grown by the Landreths, near Philadelphia, to whom it was sent from Arizona. Some found by Dr. Williams, of Houston, Texas, is a white flint of large size; but fifteen stalks produced only four ears, which grew on two of the stalks. The plant is a very vigorous grower, but it is not productive, and eight stalks grown in Texas did not bear a single ear. It may be doubted whether the evidence is as yet sufficient or is clear enough to establish that these specimens are really wild corn and not corn that has escaped from cultivation—the more so, because Indian corn with glumes to each kernel is not rare.

Dr. Yersin and Plague Virus.—Nature, of February 18th, brings an interesting account of Dr. Yersin's discovery of the plague virus and its antitoxine, during the epidemic at Hong Kong in the spring of 1894. His attention being attracted to the extraordinary number of dead rats lying about in the squalid Chinese quarters of the city, he examined them, and discovered immense numbers of a short bacillus, that could be easily stained and cultivated in the usual manner. He found the same bacilli in different organs of plague patients. Noticing quantities of dead flies in the room where he carried on his post-mortem examinations, he investigated this symptom, and established

by experiment that these insects also were infected, and assisted in the spread of the disease. He forwarded cultures of his bacillus to the Pasteur Institute at Paris. Experiments made on rabbits and guinea pigs proved that the dead bacilli, if injected in sufficient number, are deadly; smaller quantities, however, act as a vaccine, and protect the subject against stronger inoculation. Experiments with larger animals, such as horses, were equally successful. "That the most remarkable therapeutic value attaches to anti-plague serum, as now elaborated at the Pasteur Institute in Paris, is shown by the success which has recently followed its application in undoubted cases of plague at Amoy, by Yersin, now director of a Pasteur Institute at Wha-Trang in Annam.

Marriage of the Dead.—Among the many curious practices that Marco Polo came across in his travels in the far East, the Tartar custom of marrying the dead deserves notice. He says: "If any man have a daughter who dies before marriage, and another man have had a son also die before marriage, the parents of the two arrange a grand wedding between the dead lad and lass, and marry them they do, making a regular contract! And when the contract papers are made out they put them in the fire, in order that the parties in the other world may know the fact, and so look on each other as man and wife. And the parents thenceforward consider themselves sib to each other just as if their children had lived and married. Whatever may be agreed on between the parties as dowry, those who have to pay it cause to be painted on pieces of paper, and then put these in the fire, saying that in that way the dead person will get all the real articles in the other world." This custom is also noted by other writers, even as late as the beginning of the eighteenth century. It is said to have been adopted by Jenghis Khan, for political reasons, and is named in his Yasa, published in 1205 A. D.

The Three "R's" of Prehistoric Man.—M. Ed. Piette has published an interesting discovery in *L'Anthropologie*, (vol. vii, 1896, p. 385). He found in a cave at Mas-d'Azil, in the department of Ariège, a quantity of pebbles, rounded, oblong, and flattened, such as are taken from river beds. They were variously painted with peroxide of iron; some had their whole surface colored, and others again showed a border around the margin, or were dotted and striped in different designs. Crosses, serpentine patterns, and even trees could be traced out. M. Piette thinks that according to these devices the pebbles stand for numerals, symbols, pictographic signs, and alphabetic characters. He gives loose rein to his fancy in interpreting them, especially the last named. He reaches the startling conclusion that some are probably syllabic signs, used for inscriptions or in building up words. Twenty-five colored plates accompany the memoir, and give food for speculation on these cabalistic memorials of a bygone era.

Animals on the March.—Among the animals that take long journeys in great numbers are the springbok, the American bison, the musk ox, and, in smaller bodies, wild horses and the antelopes of the steppes. Journeying mostly over the plains, they nearly always move in a wide front, a way of marching that gives an equal chance to all in browsing. Some species of birds also migrate on foot. The guinea fowls always go in single file, a favorite mode of travel in Central Africa, where paths have to be cut through the dense scrub or impassable forests. The European wild geese are the champion walkers among birds. Belying the stigma attached to their name, they show much forethought in their pedestrian expeditions, which are undertaken either to accompany their young, or during the molting season. Unhasting, yet unresting, they march ahead in column, often ten geese abreast, careful not to jostle their neighbors, with head erect in the air. From time to time the leaders give the signal to halt and feed, and then to "fall in" again and continue on the road. Abroad, before the days of railways, dealers in poultry, making use of this marching power, often saved expense by letting the geese transport themselves. Droves numbering nine thousand have walked over the road from Suffolk to London. At Antwerp not long ago large flocks were seen marching up the plank to a steamer bound for Harwich, and then gravely descending to the lower deck to range themselves in an inclos-

ure, quite unwittingly going to their own death. Animals on the march rarely suffer from hunger. The quadrupeds, being all vegetarians, go toward the regions of their food supply. Birds "feed up" for a time before their migration, and during their sea trips live on the fat stored away on their bodies. Fish on the march are the most leisurely of creatures. Floating along with hardly any efforts of propulsion, and constantly surrounded by their food supply, they appear the favored among travelers.

Maori Tattooing.—Major-General Robley, who has studied the tattooing, or "moko," of the Maoris, represents that the custom is no longer practiced among the men. King Tawhaio, two years ago, carried to his grave "one of the last really fine specimens of moko." Apparently every chief who was decorated had a special design, and a variety of beautiful patterns in arabesque arose. They certainly show, the Athenæum says, that a variety of designs can be derived from the adaptation of scroll work to the outlines of the human face, and exhibit much technical skill in dealing with an intractable material. The work was done with a chisel made of a sea bird's wing bone or a shark's tooth, a fragment of stone or hard wood, ground down to a fine edge, which was driven into the skin by a smart tap, causing a deep cut and much effusion of blood, which was wiped away with the flattened end of the mallet or with a wad of flax. After contact with Europeans, iron chisels were sometimes used. The association of a special design with the individual tattooed had the advantage of serving as a means of identification, and this led to the curious result that Maori chiefs attached as their signature to deeds and other documents a facsimile of the moko tattooed on their faces. It is said that even an enemy would respect a head conspicuous for a beautiful moko.

The Caucasus as a Pleasure Resort.—The Caucasus Mountains are held up by Sir Douglas Freshfield, who knows them well, as a desirable pleasure resort and especially well adapted to a horseback excursion. Provisions are plenty, and the configuration of the region lends itself to a riding tour. The Caucasus is suited for general travelers, for lovers of the picturesque, whether or not they are painters, as well as for peak-hunters. If above its snow level its granite crests, its icy hollows, its hanging glaciers, and fluted snow slopes impress the intruder with a sublimity beyond that of the Alps, its high valleys have attractions for men of the most various pursuits and hobbies. The physical geographer will find materials for a contrast between the features of the Caucasus and those of better-known ranges. For example, why do so many Caucasian glaciers fail to fill their valleys and leave a pleasant dell between the moraines and the mountain sides? . . . I am not competent and do not attempt to act as a guide to the Caucasus as a whole. My 'Central Caucasus' bears to the whole region something of the same proportion that the Central Alps, between the Little St. Bernard and the Bernina Pass, do to the Alpine chain. It is the most important section, but it is only a section. On one side, to the east, lie the wild highlands of Daghestan, the scene of Schamyl's resistance, with their high plateaus cleft by narrow ravines, their hill fortresses, and at least three high glacier groups. On the west stretch the great forests and granite crests which hem the tributaries of the Ruban, a region probably of extraordinary beauty. The glaciers of one of its groups have just been mapped for the first time by the Russian surveyors. They are otherwise wholly unexplored. The only travelers to penetrate these fortresses have been Dr. Radde, who has, in *Petermann's Mittheilungen*, published an account of his journeys, a stray botanist or two, and those indefatigable pursuers of wild animals, Mr. and Mrs. Littledale, who have hunted the aurochs in the wilds of the Zelentshuk."

Historical Wampum Belts.—One of the last papers of the late Horatio Hale was recently communicated to the Anthropological Institute, London, by Prof. E. B. Tylor, and related to four historical Huron wampum belts. To this Prof. Tylor added some remarks of his own, which were illustrated by the exhibition of specimens and lantern slides. It was explained how the Iroquois belt might be distinguished from others by the occurrence of diagonal bands of beads,

contrasting in color with those forming the ground. These diagonals are derived from the diagonal rafters of the peculiar "long houses" of the Iroquois. Other well-known conventional symbols represent hearts, houses, lands, the "peace path," etc. One of the belts exhibited was itself a historical record of some interest, as it depicted a proposal of conversion to Christianity made by the early Jesuit missionaries to the Indians, the message being effected by working into a wampum belt a symbolic group consisting of the lamb, the dove, and several crosses. The investigations made by Mr. Hale seem to show that the "Penn Belt," which is now in New England, is not a record of the famous scene depicted by Benjamin West, but of a more obscure treaty concluded with Iroquois chiefs. The intrinsic evidence afforded by the belt convinced Mr. Hale that it was made by Iroquois. In this way anthropology has been able to correct history. The speaker also illustrated the use of wampum belts as records in modern times, exemplified by the annual meeting of chiefs, at which all the belts are carefully gone over, in order that events of tribal importance may be kept green.

Elephants in a Lumber Yard.—No work done by elephants perhaps requires at once greater intelligence and strength on their part than that of those which are used in unloading and piling up timber in the lumber yards of Burmah. The most important of these lumber yards, at Rangoon, receives the timber that comes down from the immense forests of the Irrawaddy, with the great logs lashed together into huge rafts. The workmen cut the cords, and the task of the elephants begins. Plunging without hesitation into the muddy waters of the river, they go at once toward the logs. Each animal selects a stick, pushes it with his trunk to the shore, picks it up, and lands it, all that his driver has to do being to indicate what log he wishes taken. Twelve of these animals, according to M. Charles Marsillon, eleven males and one female, work constantly in the yard. The female is the most intelligent of all of them. At the sawmill she places the piece to be cut before the saw. She uses her trunk as a hand; takes the boards away as they are made, and piles them symmetrically in the drying heap. As the sawdust accumulates and threatens to cover everything up, she blows it away with her powerful nostrils, keeping the place cleared so that the work can go on unobstructed. When the dinner bell rings, nothing—neither threats nor caresses—can keep her in the yard, industriously as she has worked till then. She seems to see to it too that her companions also stop. The elephants return to work immediately the signal is given. Sometimes one of them comes upon a stick that is too heavy for him to handle alone; and then one of his companions, perceiving his trouble, will come to his assistance. It seems to be one of the easiest things in the world for these animals to arrange and straighten the pile of logs whenever it begins to take a crooked or uneven shape. If they are not able to do this with their trunks, they use their tusks until the pile is got into order. They work willingly and with interest, call for help when they need it, and respond to one another's appeals.

Substitutes for Glass in Germany.—An interesting account of glass substitutes is given in a recent copy of the Journal of the Society of Arts. Tectorium, which is used in Germany as a substitute for glass, is a sheet of tough, insoluble gum—said to be bichromated gelatin—about one sixteenth of an inch thick, overlying on both sides a web of galvanized iron or steel wire, the meshes of which are generally about one eighth of an inch square. It feels and smells similar to the oiled silk that is used in surgery. It is lighter than glass, tough, pliant, and practically indestructible by exposure to rain, wind, hail, or any shock or blow which does not pierce or break the wire web. It may be bent into any desired form, and when punctured can be easily repaired. Its translucency is about the same as that of opal glass, with a greenish amber color, which fades gradually to white on exposure to the sun; so that while arresting the direct rays of sunshine, it transmits a soft, modulated light, which is said to be well adapted to hothouses and conservatories. It is a poor conductor of heat and cold. Its surface is well adapted for printing in oil colors, and is thus valuable for decorative purposes. The objections against it are that it is inflammable, and is apt to soften in warm weather. For hot-

beds and forcing houses the Germans have another substitute glass called *Fensterpappe*, which is a tough, strong manilla paper which is soaked in boiled linseed oil until it becomes translucent and impervious to water. This paper costs wholesale in Germany about 19*s.* 6*d.* per roll one hundred metres in length by one metre in width. It admits sufficient light for growing plants, does not require to be shaded in hot sunshine, is light, durable, and practically secure against breakage, and is said to be a hundred times cheaper than glass. There is a new product recently patented and placed on the German market, called *Hornglas*. It is very similar to tectorium in appearance and properties, the two advantages claimed for it being greater transparency and less liability of softening under a hot sun.

Animal Traits.—Among the birds in the "Zoo" at the Hague not commonly found in menageries is the "rhinoceros bird," or "buffel pikker," from the Transvaal, which is described by the natural-history writer in the London Spectator as a bird of remarkable habits and unusual plumage. Small flocks of these birds accompany most of the large antelopes, the buffaloes, and the rhinoceroses in South Africa, and run all over the creatures' bodies, picking off flies and insects. When an enemy approaches, the "buffel pikkers" sit in line with heads raised on the back of the animal they are attending, like sparrows on a roof ridge, and signal the alarm. The plumage is close, uniform, and compact, giving the bird an appearance of being covered with polished satin rather than with feathers. The monkeys have an outdoor house, floored with loose sand, exactly suitable for a playground agreeing with their natural habits, which communicates with their cages by holes through the wall. The holes fairly represent the rock crevices in the animals' native hills, and the monkeys slip through them to the sand, which they can turn over in search of insects, as they do at home. When thirsty, they go to the stone water troughs set in the runs and drink, standing on all fours, sucking up the water as a horse does. The elephant in this Zoo has had to sacrifice his dignity and come down to playing tricks. It earns small coins by blowing a mouth organ with its trunk and grinding a coffee mill. It plays dominoes "with laborious care," lifting each piece from the table and depositing it next that placed by the keeper, with a very audible noise.

Canon Gore on Evolution and the Fall.—In a lecture recently delivered at Sheffield, England, Canon Gore examines the contradictions between the Christian doctrine of the sudden fall and the scientific doctrine of the gradual rise of man. "According to the theory of evolution," he said, "man began his career at the bottom, emerging from purely animal life, and slowly struggled upward to his present level of attainment. According to the Christian doctrine, on the contrary, he was created perfect, and then subsequently fell into sin and accompanying misery." Intellectually, however, the Bible does not represent primitive man as perfect. His faculties at the beginning were in a childish state, and his mastery over the arts and sciences was a gradual acquirement. But it maintains that man from the first was endowed with a perfected moral feeling for right and wrong, and that his one act of disobedience not only affected his own life but also tainted with lawlessness his after-comers. Canon Gore maintains that according to the third chapter of Genesis man was at first in direct relation to a divine will, and could have followed the path of development pointed out to him. He thereby would have spiritualized not only his own nature, but by the simple law of heredity would have fathered a race moving in an altogether higher moral sphere.

Marsupials and their Skins.—The marsupials (the pouch-bearing animals) of Australia, the opossums, wombats, kangaroos, and wallabies (smaller kangaroos), are among the fur-bearing animals killed in the largest numbers. They have been looked upon as pests, and a premium put upon their heads by the Government, so that now they are exterminated in many parts of the country. Their skins are not at all estimated at their proper value, being mostly made up into cheap rugs, or used for sole leather and japanned boots, or the hair is scraped off and manufactured into felt. Yet they would be a valuable addition to the European fur trade, were the

animals not constantly killed and the skins shipped to England in the summer, when the fur is almost useless. The coat, especially of the kangaroo, is close and soft like plush, with beautiful tints of French gray, warm red, orange, and rose color. The famous "boxing kangaroo" attracted a good deal of attention some three years ago. It earned an immense sum of money, sometimes given as £20,000. It had not received any special training; its keeper simply took advantage of the fact that a tame kangaroo who knows its master will always "box" when invited to do so, putting up his short forearms to ward off any imaginary blows. This kangaroo set the fashion for the sport, for the animals at once were sought after for sparring exhibitions, and for a time all the kangaroos in Europe outside of the menageries nightly drew crowds to their pugilistic feats. Kangaroos easily adapt themselves to the European climate; they thrive well in the zoölogical gardens, and have even been successfully kept on private estates in England. Their graceful poses and their soft, beautifully tinted coats make them objects of general attraction.

Roadside Orchards.—The experiment of planting fruit trees along the sides of public highways has been tried with satisfactory results in several German states and in Austria, and the products of the plantations have been the means of adding considerably to the revenues of the Governments thereof. In Saxony the profit derived by the state from that source during fourteen years is estimated at about four hundred thousand dollars. Planting of forest trees by the sides of the roads has been abandoned in Würtemberg, and the plantation and care of fruit trees are regulated by law. The trees are placed in the care of the abutting proprietor under the supervision of the highway inspector. In Bavaria and the Palatinate each road man is duplicated by a horticulturist, for whose qualification special instruction is provided, and who has to pass a competitive examination. In some regions the lines of the railroads are also planted, and in others the minor roads and even private roads. The system has made the most rapid progress and reached the highest development in the grand duchy of Luxemburg, where special classes are held every year, under a professor in the agricultural school, for teaching the inspectors and road hands the theoretical and practical elements of the orchardist's art.

The Dalai Lama.—Mr. St. George R. Littledale, who traveled in Tibet in 1894, learned from an interpreter that the Dalai Lama then reigning was about twenty years old, and was to come of age in the succeeding November. The Rajah of Lhasa, who was acting as regent, would then lose his power and retire into private life. The last two Dalai Lamas had died between the ages of eighteen and twenty, which seemed to be a peculiarly fatal period in the lives of these potentates. The present regent had held office for forty years, and might perhaps have given interesting details of the last illnesses of two of his sovereigns. The Dalai Lama, however often the dignitary may be reincarnated, never really dies; the incarnation descends to some infant, whom it is the business of the lama priesthood to discover. When found, he is brought to Lhasa, surrounded by crowds of lamas, who educate him for the position he is so seldom allowed to fill. The Dalai Lama of Mr. Littledale's time was discovered as a baby at Thokopo, five days from Lhasa. The Teshu Lama at Shigatze was a boy of twelve or thirteen, who during his minority was under the tutelage of Lhasa. When a Tibetan lama dies, they carry the body to a mountain, cut it to pieces, and the vultures do the rest. The Dalai Lama is embalmed, and gold and jewels are inserted into his face. The three great incarnations—the Dalai Lama, the Teshu Lama, and the Taranath Lama—are all equally holy, and their sedan chairs, when in Lhasa, are each carried by eight bearers, while the two Chinese mandarins are allowed only four bearers apiece.

Quick Growth of a Myth.—A pertinent illustration of the way myths and legends may grow and expand is illustrated by the story of Alexander (the Great), of which Mr. E. A. Wallis Budge has published the Syriac and Ethiopic versions. No instance of the development of fables, says the Athenæum's review of one of these publications, can be more instructive; for we start from a real

man, living in the clear light of history, whose acts were chronicled at the time by respectable historians. Nevertheless, so transcendent was his genius, so marvelous were his deeds, that almost immediately after his death—probably, indeed, during his life—popular imagination lays hold of him, adds adventures, miracles, words of wisdom, wonders of all sorts, and so transforms him into a colossal mythical figure, which looms through the mists of fable, as fantastic as Jack the Giant Killer. The diffusion of the Alexander stories is probably the widest ever attained by any heroic legend. "There are versions of them stretching through all the middle ages in time, and reaching in space from the Malay Peninsula to Ireland; and, as every nation has desired a popular or home edition, we can even yet find either complete or partial texts in at least twenty-three languages." Dr. Budge describes the process of amplification of the myth as starting with the distortion and enlargement of the first tolerably accurate description, and going on till, "when the hero has become a mere memory, his name will be made in each country that adopts the story a peg on which to hang legends and myths."

MINOR PARAGRAPHS.

A bow and arrows taken from an Egyptian tomb of the twenty-sixth dynasty and exhibited to the London Anthropological Institute differ in a very marked manner from the native Egyptian bows, and are believed to be of Assyrian origin. The differences are very evident when a comparison is made with the typical Egyptian archer's equipment which was found in the same tomb. The bow is elaborately built up of several materials, and is therefore to be classed with the "composite bows," being allied to the modern Asiatic bows comprised under this term. The materials of which it is composed are wood (two kinds), dense black horn, sinews of animals, birch bark, and glue. The birch bark, which completely enveloped the bow in a continuous sheath, would of itself proclaim the implement to be a foreign and northern introduction into Egypt, and the whole character of the weapon bears out this supposition.

It is related in the Life of Brian Houghton Hodgson, the first great collector of Buddhist manuscripts, that while seeking for books in Nepaul he was surprised at the wide diffusion of literature among the masses. He attributed it to the knowledge of printing which the Tibetans had derived, probably, from China. "But the universal use they make of it," he said, "is a merit of their own. The poorest fellow who visits this valley is seldom without his religious tract, and from every part of his dress dangle charms made up in slight cases, whose interior exhibits the neatest workmanship." The universal use of writing, as shown by the abundance of manuscripts, was hardly less noticeable than the wide diffusion of printed books. The writing of many of these ancient manuscripts exhibits fine specimens of very graceful penmanship; and they owe their preservation, the author of the memoir says, to having been guarded in their wrappings of silks as sacred heirlooms.

The well-known germicidal qualities of oxygen have led to its recent application in the treatment of surgical wounds. Examinations of the bacteriological conditions of affected parts before and after treatment, says Mr. George Stoker in a recent British Medical Journal, show that oxygen has a selective action in reference to micro-organisms. Whatever may be the connection between the organisms and the state of a wound or sore, it seems to be established that when in a wound treated by oxygen healing is arrested or retarded, there is always a corresponding decrease of favorable and increase of unfavorable micro-organisms. If the strength of the oxygen bath be increased when this condition arises, the character of the micro-organisms from the wound is entirely reversed. A long and varied experience of the oxygen treatment has led Mr. Stoker to conclude that the method heals in less time than any other form of treatment, allays pain, stops foul discharges, forms a healthy new skin, and is far more economical than any other form of treatment, both as regards suffering and money.

The scientific merits of archæology were well set forth in an address made by Mr. W. M. Flinders Petrie at the recent annual

meeting of the Egypt Exploration Fund. The science had made great advances, one indication of which was the unexpectedly large circulation of books on the subject. There had, too, been a more scientific spirit shown in its treatment, and problems were approached simply with the desire to learn the truth, and not with the expectation of proving something. The time had indeed come when archæology was regarded as one of the elements of a liberal education. It was now fully recognized that it was not a mere fad or dilettant amusement, but had thrown great light on the history of the human mind.

NOTES.

At the meeting of the Council of the American Association for the Advancement of Science, held at Washington April 21st, Prof. Theodore Gill, as senior vice-president, succeeded under the constitution to the position of acting president, *vice* E. D. Cope, deceased. Prof. Gill was requested by vote of the Council to prepare an obituary notice of President Cope, and to deliver it before the association at the Detroit meeting in lieu of the ordinary presidential address by the retiring president, and he undertook to do so. Prof. Leland O. Howard was nominated vice-president for the Section of Zoölogy (Section F), *vice* G. Brown Goode, deceased.

The observations of Mr. Percival Lowell at Flagstaff, Arizona, in which he assumes to have had vastly more distinct views of the planet's disk than were ever before obtained, indicate that the period of the diurnal rotation of Venus is identical with that of its revolution round the sun. Hence it has one side constantly turned toward the sun and the other constantly averted from it—everlasting burning heat on one side and never-intermitted cold on the other.

A proposition is under consideration in the English scientific societies for the establishment, in commemoration of the sixtieth year of her Majesty's reign, of a Victoria Research Fund, to be administered by representatives of the various scientific societies for the encouragement of research in all branches of science.

The people of Detroit are working earnestly in preparation to give the American Association a cordial welcome and hospitable entertainment at its coming meeting there. A general interest seems to be taken in the matter, as was exemplified by the recent attendance of an audience of twenty-five hundred persons upon a lecture by the secretary of the association, Prof. Putnam. The press is co-operating with the citizens' committee in making the interest lively, and the effect is apparent in the subscription lists. While it is already reasonably certain that all who go to the meeting will be well and amply taken care of, the people hope that their invitation will be responded to by a large attendance of Americans and Englishmen and others interested in science.

The work in anthropology in the University of Chicago, for the present associated with that in sociology, includes courses in general anthropology, general ethnology, prehistoric archæology (European and American, in alternation), ethnology (the American race), physical anthropology (elementary and laboratory courses), laboratory work, Mexican ethnography and archæology, ethnology of Japan, the pueblos of New Mexico, and lectures by Dr. W. I. Thomas on folk psychology, primitive art, and Slavic ethnology. Several important collections are on deposit in the university, representing Mexican archæology, the cliff dwellings and cave house of Utah, the Aleutian Islands and Eskimos, Japan, and the collection of the International Folklore Association.

The Blue Hill Meteorological Observatory, Massachusetts, was established in 1885 by Mr. A. Lawrence Rotch, and is maintained by him at his own expense. By arrangement it co-operates with the observatory of Harvard College, and its observations are published, partly at Mr. Rotch's expense, in the annals of that institution. Since the land surrounding the observatory has been taken for a public park, a lease for ninety-nine years has been taken of the ground it needs, which will enable its work to be continued under invariable conditions of exposure.

The French journal *L'Anthropologie* publishes an account of the discovery of the Moi race of tailed men by M. Paul d'Enjoy in Indo-China. M. d'Enjoy saw only one of the men, the rest of the village having run away, but he conversed with this one and saw where the people lived. The man was found in a large tree, into which he had climbed for honey. His climbing was like that of a monkey, and in coming down he applied his sole to the bark. The tail is not the only peculiarity of this race, for their ankle bones are extraordinarily developed, so as to resemble the spurs of roosters. The Mois use poisoned barbed arrows, and are treated by the natives around them as brutes.

Baron Constantin Ettingshausen has died at Graz, aged seventy-one. Beginning his scientific career as a doctor, he later on devoted himself to the study of botany and paleontology. He arranged the paleontological collections in the British Museum (natural history). He wrote many papers for the Proceedings of the Royal Society, and for the journals of other learned bodies.